Project: ***X1348CB0***
Piscataway WWTP ENR Upgrade *Rev. 0*
Milford, DE

Operation & Maintenance Manual

11342: Viking Carbon Recirculation Pumps

Prepared For:

Norair Engineering Corp.
337 Brightseat Road Suite 200
Landover, MD 20785
Purchase Order No. 2321-101

July 23, 2012

Local Representative:

Geiger Pump & Equipment Co.
8924 Yellow Brick Road
Baltimore, Maryland 21237
Telephone: (410) 682-2660
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Project:	Piscataway WWTP ENR Upgrade
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Section 11342: Viking Carbon Recirculation Pumps
Section 1: Project Documents

AUTHORIZED SERVICE FACILITY

The local authorized facility for field service, repair, and spare parts is:

Geiger Pump and Equipment Co.
8924 Yellow Brick Road
Baltimore MD 21237

Phone: 410 682-2660
Fax: 410 682-4750
Email: info@geigerinc.com

In the event of failure, for warranty services contact the above Authorized Service Facility.

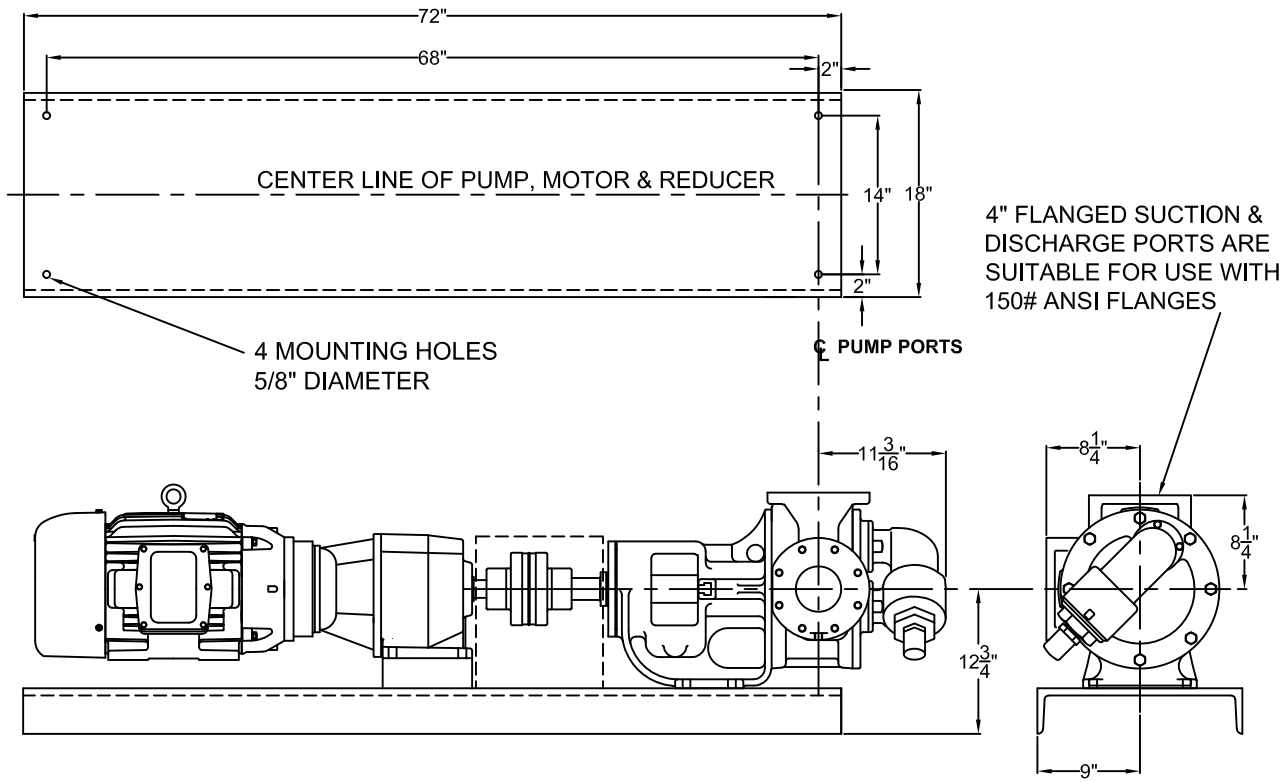
SCOPE OF SUPPLY

Section 11342: Carbon Recirculation Pumps

Qty two (2) Viking Pumps (IDEX), model QS4127A gear pumps, in stainless steel construction as specified, with 10Hp explosion proof premium efficiency c-face motors, 3ph 460V 60Hz, single cartridge mechanical seals as specified, in-line-gear reducers, coupling guard and fabricated baseplate

Equipment Tag Numbers:

CRP-1	Carbon Recirculation Pump No. 1
CRP-2	Carbon Recirculation Pump No. 2



PUMP SPECIFICATIONS

Viking Model:	Q4127A	**Rotor:**	316 SS
Casing:	316 SS	**Shaft:**	316 SS
Idler:	770 SS	**Brkt Bushing:**	CG
Idler Bushing:	CG	**Rotation:**	RH
Relief Valve Set @ 35 PSIG			

Mechanical Seal

Manufacturer:	Flowserve	**Elastomers:**	Viton
Type:	84	**P/N:**	2-480-304-999

MOTOR

Manufacturer:	Baldor/Reliance	**RPM:**	1800
Model:	CEM7054T (B)	**Frame:**	254TC
HP:	15	**Enclosure:**	Exp Proof
Volts/Ph/Hz:	230-460/3/60	**SF:**	1.15

GEAR REDUCER

Manufacturer:	Viking	**Size:**	51
Model:	3-551-51C-056-25	**Gear Ratio:**	5.63:1

COUPLING

Manufacturer:	TB Woods	**Pump Bore:**	1 15/16"
Model:	9SC35 W/ Hytrel Sleeve	**Gear Bore:**	1.9/16"

PROCESS SPECIFICATIONS

Fluid:	Carbon Chemical Solutions	**SG:**	0.80 to 1.22
Flow (GPM):	150	**Visc (CPs):**	1.2 to 450
TDH (PSI):	20 PSIG		

COUPLING GUARDS: NON-SPARKING ALUMINUM

MODIFIED STRUCTURAL STEEL BASE: 18" x 42.7# / FT CHANNEL STEEL

IMPORTANT:

1. VIKING PUMPS OPERATE EQUALLY WELL IN EITHER DIRECTION OF ROTATION. RELIEF VALVE BONNET ALWAYS POINTS TOWARDS SUCTION. STANDARD ARRANGEMENT IS RIGHT HAND SUCTION, HYDRAULIC INSTITUTE - CLOCKWISE ROTATION AS SHOWN ABOVE.
2. PUMPS NOT FURNISHED WITH A RELIEF VALVE MUST BE FURNISHED WITH SOME MEANS OF PRESSURE PROTECTION (IN-LINE PRESSURE RELIEF VALVE, TORQUE LIMITING DEVICE, ETC.). FOR ADDITIONAL INFORMATION ON PRESSURE RELIEF VALVES, REFER TO VIKING PUMP TECHNICAL SERVICE MANUAL TSM000 AND BULLETIN ESB-31.

GENERAL NOTES:

1. CONSULT TECHNICAL SERVICE MANUAL BEFORE INSTALLING UNIT.
2. ALL DIMENSIONS GIVEN IN INCHES UNLESS OTHERWISE SHOWN.
3. ALL PIPE TAPS ARE STANDARD NPT THREADS.
4. ALL HOLES IN FLANGES STRADDLE CENTERLINES.
5. ALL FLANGES CONFORM TO ANSI STD DRILLING UNLESS OTHERWISE SHOWN.
6. FOUNDATION BOLTS AND PIPING SHOULD NOT BE SET RIGIDLY UNTIL RECEIPT OF EQUIPMENT.
7. ALL PIPING TO AND FROM PUMP MUST BE INDEPENDENTLY SUPPORTED AND RIGIDLY ANCHORED.
8. BOLTS AND STUDS FOR MATING FLANGES NOT FURNISHED. USE FLAT WASHERS BEHIND FLANGES.
9. WHEN LIFTING UNIT DO NOT LIFT ON SHAFT EXTENSION OR SUCTION AND DISCHARGE FLANGES.
10. THE DESIGN OF PIPING SYTEM, FOUNDATIONS, AND OTHER AREAS OF SYSTEM DESIGN ARE RESPONSIBILITY OF OTHERS. SMITH-KOCH DATA AND COMMENTS ARE OFFERED AS AN AID, BUT SMITH-KOCH CANNOT ASSUME THE RESPONSIBILITY FOR THE DESIGN AND OPERATION.

Geiger Pump and Equipment, Co.

8924 Yellow Brick Road, Baltimore, MD 21237

TITLE **Q4127A**

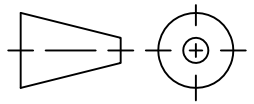
Customer: Piscataway ENR

Purchase Order: 321-101

Tag Number:

Service:

THIRD ANGLE PROJECTION



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Certified		Date	
SHOP TICKET X1348CB1	**DRAWING NO. 10K0981B**	SCALE: NONE	REV B

Section 11342: Viking Carbon Recirculation Pumps
Section 2: Pump O&M Manual

Electronic copies of the most current TSM issue can be found on the Viking Pump website at www.vikingpump.com

VIKING PUMP

TECHNICAL SERVICE MANUAL

UNIVERSAL SEAL HEAVY DUTY PUMPS
SERIES 124A/E/EH, 4124A, 224A/AH, AND 4224A/AH CAST IRON
SERIES 126A, 4126A, 226A AND 4226A DUCTILE IRON
SERIES 123A, 4123A, 223A AND 4223A STEEL
SERIES 127A, 4127A, 227A AND 4227A STAINLESS STEEL
SIZES LS, Q AND QS

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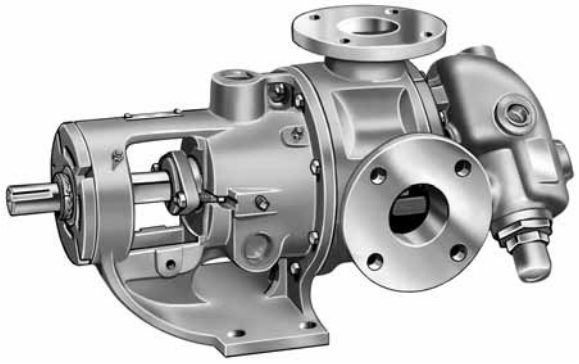


FIGURE 1
Size LS illustrated
(Shown with jacketed bracket and relief valve)

INTRODUCTION

The illustrations used in this manual are for identification purposes only and cannot be used for ordering parts. Obtain a parts list from the factory or a Viking representative. Always give a complete name of part, part number and material with the model number and serial number of pump when ordering repair parts. The unmounted pump or pump unit model number and serial number are on the nameplate.

In the Viking model number system, basic size letters are combined with series number (124A, 4124A, 124E, 124EH, 126A, 4126A, 123A, 4123A, 127A, 4127A, 224A, 224AH, 4224A, 4224AH, 226A, 4226A, 223A, 4223A, 227A, 4227A) indicating basic pump construction material.

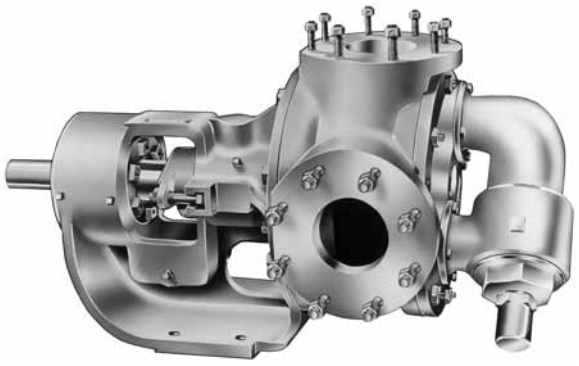


FIGURE 2
Size Q illustrated
(Non-Jacketed)

Model Chart Number

UNMOUNTED PUMP				
Non-Jacketed		Jacketed		
Packed	Mech. Seal	Packed	Mech. Seal	UNITS
LS124A	LS4124A	LS224A	LS4224A	Units are designated by the unmounted pump model numbers followed by a letter indicating drive style.
LS124E		LS224AH	LS224AH	
LS124EH	LS4126A	LS226A	LS4226A	
LS126A		LS223A	LS4223A	
LS123A	LS4123A	LS227A	LS4227A	
LS127A	LS4127A	Q224A	Q4224A	
Q124A	Q4124A	Q226A	Q4226A	V = V-Belt
Q124E		Q223A	Q4223A	D = Direct Connected
Q126A	Q4126A	Q227A	Q4227A	R = Viking Speed Reducer
Q123A	Q4123A	QS226A	QS4226A	
Q127A	Q4127A	QS223A	QS4223A	P = Commercial Speed Reducer
QS124A	QS4124A	QS227A	QS4227A	
QS124E				
QS126A	QS4126A			
QS123A	QS4123A			
QS127A	QS4127A			

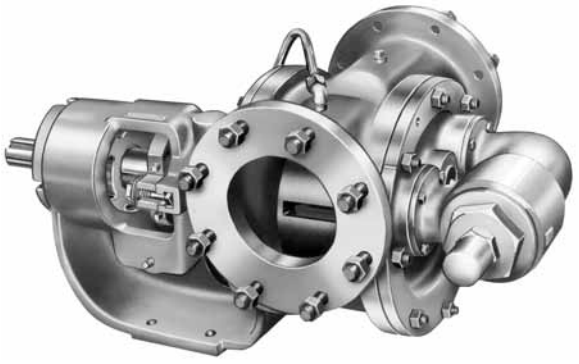


FIGURE 3
Size QS illustrated
(Non-Jacketed)

SAFETY INFORMATION AND INSTRUCTIONS

IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF PUMP MAY CAUSE SERIOUS INJURY OR DEATH AND/OR RESULT IN DAMAGE TO PUMP AND/OR OTHER EQUIPMENT. VIKING'S WARRANTY DOES NOT COVER FAILURE DUE TO IMPROPER INSTALLATION, OPERATION OR MAINTENANCE.

THIS INFORMATION MUST BE FULLY READ BEFORE BEGINNING INSTALLATION, OPERATION OR MAINTENANCE OF PUMP AND MUST BE KEPT WITH PUMP. PUMP MUST BE INSTALLED, OPERATED AND MAINTAINED ONLY BY SUITABLY TRAINED AND QUALIFIED PERSONS.

THE FOLLOWING SAFETY INSTRUCTIONS MUST BE FOLLOWED AND ADHERED TO AT ALL TIMES.

Symbol Legend :

Danger - Failure to follow the indicated instruction may result in serious injury or death.

WARNING

Warning - In addition to possible serious injury or death, failure to follow the indicated instruction may cause damage to pump and/or other equipment.

BEFORE opening any liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) be sure that :

- Any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.
- The pump drive system means (motor, turbine, engine, etc.) has been "locked out" or otherwise been made non-operational so that it cannot be started while work is being done on the pump.
- You know what material the pump has been handling, have obtained a material safety data sheet (MSDS) for the material, and understand and follow all precautions appropriate for the safe handling of the material.

BEFORE operating the pump, be sure all drive guards are in place.

DO NOT operate pump if the suction or discharge piping is not connected.

DO NOT place fingers into the pumping chamber or its connection ports or into any part of the drive train if there is **any possibility** of the pump shafts being rotated.

WARNING

DO NOT exceed the pumps rated pressure, speed, and temperature, or change the system/duty parameters from those the pump was originally supplied, without confirming its suitability for the new service.

WARNING

BEFORE operating the pump, be sure that:

- It is clean and free from debris
- all valves in the suction and discharge pipelines are fully opened.
- All piping connected to the pump is fully supported and correctly aligned with the pump.
- Pump rotation is correct for the desired direction of flow.

WARNING

INSTALL pressure gauges/sensors next to the pump suction and discharge connections to monitor pressures.

WARNING

USE extreme caution when lifting the pump. Suitable lifting devices should be used when appropriate. Lifting eyes installed on the pump must be used **only** to lift the pump, **not** the pump with drive and/or base plate. If the pump is mounted on a base plate, the base plate must be used for all lifting purposes. If slings are used for lifting, they must be safely and securely attached. For weight of the pump alone (which does not include the drive and/or base plate) refer to the Viking Pump product catalog.

DO NOT attempt to dismantle a pressure relief valve that has not had the spring pressure relieved or is mounted on a pump that is operating.

AVOID contact with hot areas of the pump and/or drive. Certain operating conditions, temperature control devices (jackets, heat-tracing, etc.), improper installation, improper operation, and improper maintenance can all cause high temperatures on the pump and/or drive.

WARNING

THE PUMP must be provided with pressure protection. This may be provided through a relief valve mounted directly on the pump, an in-line pressure relief valve, a torque limiting device, or a rupture disk. If pump rotation may be reversed during operation, pressure protection must be provided on ***both*** sides of pump. Relief valve adjusting screw caps must always point towards suction side of the pump. If pump rotation is reversed, position of the relief valve must be changed. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure. For additional information, refer to Viking Pump's Technical Service Manual TSM 000 and Engineering Service Bulletin ESB-31.

WARNING

THE PUMP must be installed in a matter that allows safe access for routine maintenance and for inspection during operation to check for leakage and monitor pump operation.

This manual deals only with Series 124A, 4124A, 124E, 124EH, 126A, 4126A, 123A, 4123A, 127A, 4127A, 224A, 224AH, 4224A, 4224AH, 226A, 4226A, 223A, 4223A, 227A and 4227A Heavy Duty Bracket Mounted Pumps. **Refer to Figures 1 through 13** for general configuration and nomenclature used in this manual. Pump specifications and recommendations are listed in Catalog Section 630, Heavy Duty Bracket Mounted Pumps, with Universal Seal Type Bracket.

SPECIAL INFORMATION

DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.**
2. **That the driving means (motor, turbine, engine, etc.) has been "locked out" or made non-operational so that it cannot be started while work is being done on pump.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

Failure to follow above listed precautionary measures may result in serious injury or death.

ROTATION: Viking pumps operate equally well in a clockwise or counterclockwise rotation. Shaft rotation determines which port is suction and which is discharge. Port in area where pumping elements (gear teeth) come out of mesh is suction port.

PRESSURE RELIEF VALVES:

1. Viking pumps are positive displacement pumps and must be provided with some sort of pressure protection. This may be a relief valve mounted directly on the pump, an inline pressure relief valve, a torque limiting device or a rupture disk.
2. There are relief valve options available on those pump models designed to accept a relief valve. Options may include a return to tank relief valve and a jacketed relief valve. Pumps equipped with a jacketed head plate are generally not available with a relief valve.
3. If pump rotation is reversed during operation, pressure protection must be provided on ***both*** sides of pump.
4. Relief valve adjusting screw cap must ***always*** point towards suction side of pump. If pump rotation is reversed, remove pressure relief valve and turn end for end.
5. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure.

For additional information on pressure relief valves, **Refer to Technical Service Manual TSM000 and Engineering Service Bulletin ESB-31.**

SPECIAL MECHANICAL SEALS:

Extra care should be taken in repair of these pumps. Be sure to read and follow all special instructions supplied with your pump.

MAINTENANCE

Viking pumps are designed for long, trouble-free service life under a wide variety of application conditions with a minimum of maintenance. The points listed below will help provide long service life.

***LUBRICATION*:** External lubrication must be applied slowly with a hand gun to all lubrication fittings every 500 hours of operation with multi-purpose grease, NLGI # 2. Do not over-grease. Applications involving very high or low temperatures will require other types of lubrication. **Refer to Engineering Service Bulletin ESB-515.** Consult factory with specific lubrication questions.

***PACKING ADJUSTMENT*:** New packed pumps require initial packing adjustment to control leakage as packing "runs in". Make initial adjustments carefully and do not over-tighten packing gland. After initial adjustment, inspection will reveal need for packing replacement. **Refer to instructions under Assembly on page 5,** regarding repacking pump.

***CLEANING PUMP*:** Keep pump as clean as possible. This will facilitate inspection, adjustment and repair work and help prevent overlooking a dirt covered grease fitting.

***STORAGE*:** If pump is to be stored, or not used for six months or more, pump must be drained and a light coat of light oil must be applied to all internal pump parts.

Lubricate fittings and apply grease to pump shaft extension. Viking suggests rotating pump shaft by hand one complete revolution every 30 days to circulate the oil.

SUGGESTED REPAIR TOOLS: The following tools must be available to properly repair Universal Seal Bracket Pumps. These tools are in addition to standard mechanics' tools such as open-end wrenches, pliers, screwdrivers, etc. Most of the items can be obtained from an industrial supply house.

1. Soft Headed hammer
2. Allen wrenches (some mechanical seals and set collars)
3. Packing hooks, flexible (packed pumps)
4. Mechanical seal installation sleeve
   2-751-005-630 for 2.4375 inch seal; Q-QS pumps.
5. Bearing locknut spanner wrench
   (Source: #472 J. H. Williams & Co. or equal);
   LS-QS pumps.
6. Spanner wrench, adjustable pin type for use on bearing housing (Source: #482 J. H. Williams & Co. or equal)
7. Brass bar
8. Arbor press

DISASSEMBLY

DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.**
2. **That the driving means (motor, turbine, engine, etc.) has been "locked out" or made non-operational so that it cannot be started while work is being done on pump.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

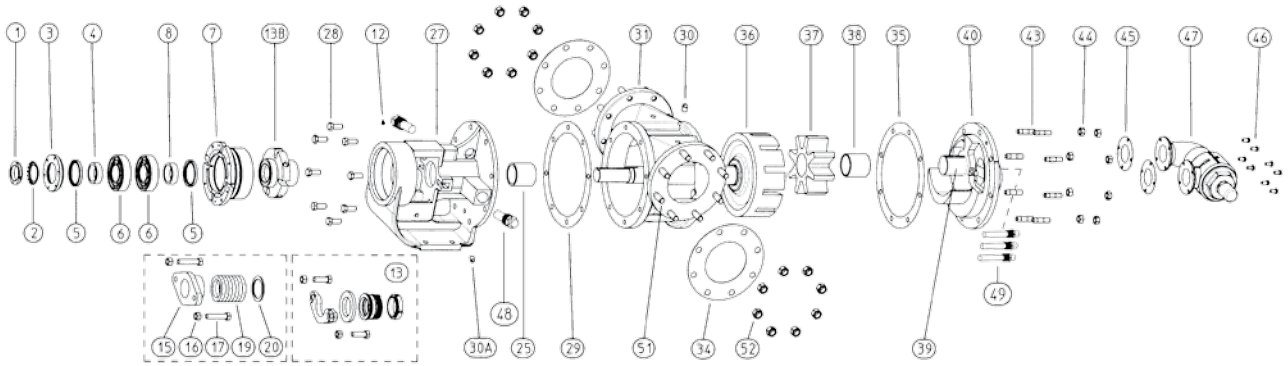
Failure to follow above listed precautionary measures may result in serious injury or death.

1. Mark head and casing before disassembly to insure proper reassembly. The idler pin, which is offset in pump head, must be positioned toward and equal distance between port connections to allow for proper flow of liquid through the pump.

   Remove head from pump. Do not allow idler to fall from idler pin. Tilt top of head back when removing to prevent this. Avoid damaging head gasket. If pump is furnished with pressure relief valve, it need not be removed from head or disassembled at this point. **Refer to Pressure Relief Valve Instructions, page 9.**

   If pump has jacketed head plate, it will separate from head when it is removed. The gasket between head and jacket head plate must be totally removed. Use new gasket when assembling pump.
2. Remove idler and bushing assembly.
3. Insert length of hardwood or brass through port opening between rotor teeth or lock coupling end or shaft to keep shaft from turning. Bend up tang of lockwasher and with a spanner wrench; remove locknut and lockwasher from shaft.
4. Loosen two setscrews in the face of the bearing housing and remove the bearing housing assembly from the bracket. **Refer to Figure 5 or 6, page 5.**
5. Remove pair of half round rings under the inner spacer collar from the shaft. **NOTE:** There are no half round rings on "Q" and "QS" size pumps.
6. Remove packing gland capscrews, slide-packing gland out of stuffing box, and remove packing.

   NOTE: Reference **Mechanical Seal Replacement** beginning on **page 6** when disassembling seal pump.



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	17	Packing Gland Capscrew	39	Idler Pin
2	Lockwasher	19	Packing	40	Head and Pin Assembly
3	End Cap for Bearing Housing	25	Bracket Bushing	43	Stud for Head
4	Bearing Spacer Collar (Outer)	27	Bracket and Bushing Assembly	44	Nut for Head
5	Lip Seal for Bearing Housing (2 Req'd)	28	Capscrew for Bracket	45	Relief Valve Gasket
6	Roller Bearing (2 Req'd)	29	Bracket Gasket	46	Capscrew for Relief Valve
7	Bearing Housing	30	Pipe Plug	47	Internal Relief Valve
8	Bearing Spacer Collar (Inner)	31	Casing	48	Heater Cartridges for Bracket (124E Pumps Only)
12	Grease Fitting	34	Pipe Flange Gasket	49*	Heater Cartridges for Head (124E Pumps Only)
13	Mechanical Seal	35	Head Gasket	51	Stud for Flanges
13B	Cartridge Mechanical Seal	36	Rotor and Shaft Assembly	52	Nut for Flanges
15	Packing Gland	37	Idler and Bushing Assembly	Not Illus.	Cover Plate, Relief Valve
16	Packing Gland Nut	38	Idler Bushing		

FIGURE 4
EXPLODED VIEW OF UNIVERSAL BRACKET PUMP (TYPICAL)

* The number of Heater Cartridges for Head varies by pump size. See Table 2 on Page 13 for the number required by pump size.

7. Carefully remove rotor and shaft to avoid damaging bracket bushing.

8. Loosen two radial setscrews in flange of bearing housing and with a spanner wrench remove the outer end cap with closure and outer bearing spacer collar.

9. Remove the double row ball bearing, (2 tapered roller bearings on “Q” and “QS” sizes), closure and inner bearing spacer collar from the bearing housing.

10. Clean all parts thoroughly and examine for wear and damage. Check lip seals, bearings, bushings, and idler pin and replace if necessary. Check all other parts for nicks, burrs, excessive wear and replace if necessary. Wash bearings in clean solvent. Blow out bearings with compressed air. Do not allow bearings to spin; turn them slowly by hand. Spinning bearings will damage bearing components. Make sure bearings are clean, then lubricate with light oil and check for roughness. Roughness can be determined by turning outer race by hand.

CAUTION: Do not intermix inner and outer races of tapered roller bearing (“Q” and “QS sizes).

11. Casing can be checked for wear or damage while mounted on bracket.

12. Inspect bracket bushing for wear and remove if damaged or worn.

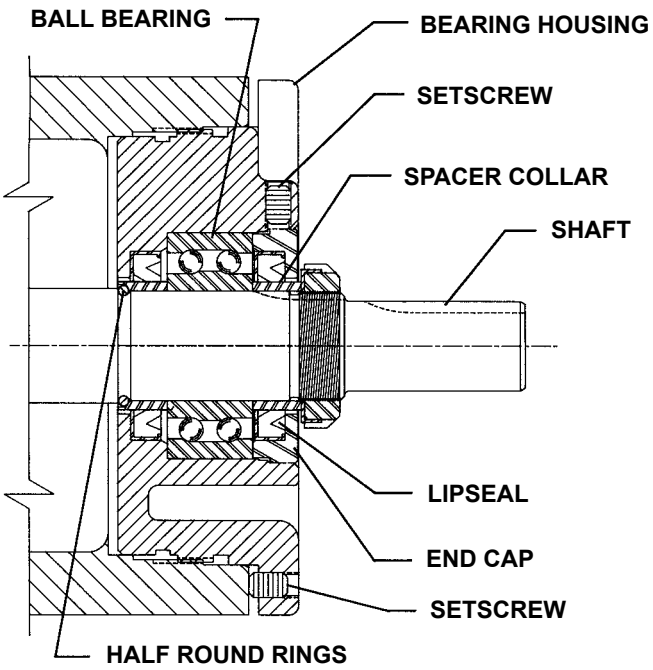


FIGURE 5
LS BEARING HOUSING ASSEMBLY

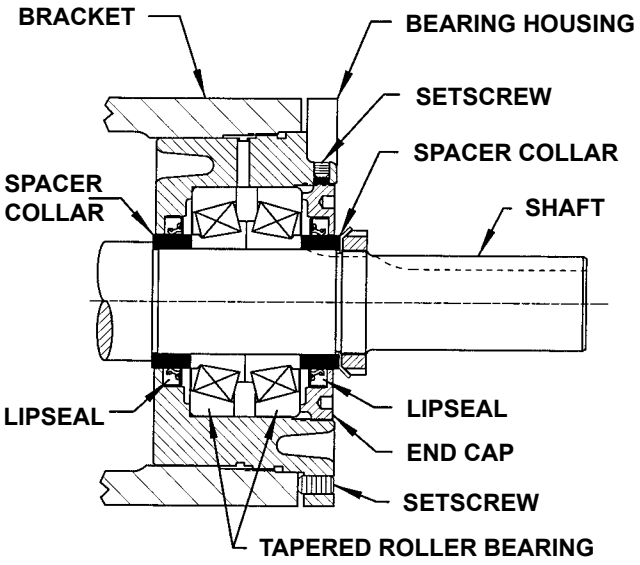


FIGURE 6
Q-QS BEARING HOUSING ASSEMBLY

ASSEMBLY

1. Install bracket bushing. If bracket bushing has a lubrication groove, install bushing with groove at 6.00 o’clock position in bracket. If carbon graphite, **Refer to Installation of Carbon Graphite Bushings, page 9.**

2. Coat shaft of rotor shaft assembly with light oil. Start end of shaft in bracket bushing turning from right to left, slowly pushing rotor in casing.

3. Coat idler pin with light oil and place idler and bushing on idler pin in head. If replacing with carbon graphite bushing, **Refer to Installation of Carbon Graphite Bushings, page 9.**

4. Using a .010 to .015 inch thick head gasket, install head and idler assembly on pump. Pump head and casing should have been marked before disassembly to insure proper reassembly. If not, be sure idler pin, which is offset in pump head, is positioned toward the equal distance between port connections to allow for proper flow of liquid through pump.

   Refer to Figure 5 and 6 for bearing housing assembly.

5. Install the lipseal in the bearing housing **(See the appropriate figure for lip orientation).**

6. **“LS” Pumps:** Pack the ball bearing with grease and push or press the bearing into the bearing housing. **Refer to Figure 5.**

   “Q” and “QS” Pumps: Pack tapered roller bearings with grease and press or push bearings into housing with large end of inner races together. It is possible to install bearings incorrectly. For proper assembly see Figure 6.

7. Install the lipseal in the end cap (see appropriate figure for lip orientation). Thread the end cap into the bearing housing along with outer bearing spacer collar and tighten against the bearing.

"Q" and "QS" PUMPS ONLY: Tapered roller bearings require preload to operate properly. To set preload tighten end cap so that inner races of bearings cannot be rotated by hand. Back the end cap off to allow inner races to rotate with slight resistance.

Lock end cap in place with two setscrews in the flange of the bearing housing.

8. When assembling pack pump, use packing suitable for liquid being pumped. Install packing, staggering the joints from on side of shaft to other. Lubricate packing rings with oil, grease, or graphite to aid assembly. Install packing, capscrews, and nuts. Make sure gland is installed square and nuts are tightened evenly. Tighten nuts until packing gland is snug against packing.

   NOTE: See Seal Installation, page 7 when re-assembling a seal pump.

9. Slide inner spacer collar over shaft with recessed end facing rotor. "Q" and "QS" bearing spacer collars are not recessed.

   Place pair of half round rings on shaft and slide inner bearing spacer collar over half round rings to lock them in place. There is no pair of half round rings on "Q" and "QS" size pumps.

10. Thread the bearing housing with lipseals; end cap, outer bearing spacer collar and bearings installed into bracket.

11. Put lockwasher and locknut on shaft. Insert length of hardwood or brass through port opening between rotor teeth to keep shaft from turning. Tighten locknut to 120-150 - ft.lbs. torque (LS) or 170-190 - ft.lbs. torque (Q,QS) . If tang does not line up with slot, tighten locknut until it does. Failure to tighten locknut or engage lockwasher tang could result in early bearing failure and cause damage to rest of pump. Remove length of hardwood or brass from port opening.

12. Adjust pump end clearance as in **Thrust Bearing Adjustment page 8.**

13. Lubricate all grease fittings with multi-purpose grease, NLGI #2.

DANGER !

Before starting pump, be sure all drive equipment guards are in place.

Failure to properly mount guards may result in serious injury or death.

MECHANICAL SEAL REPLACEMENT

This manual deals with the three standard types of mechanical seals supplied on Universal Bracket models 4124A, 4126A, 4123A, 4127A, 4224A, 4224AH, 4226A, 4223A, 4227A.

1. Cartridge **(Figure 7, page 7)**
2. Elastomeric Bellows **(Figure 9, page 7)**
3. PTFE Wedge **(Figure 10, page 7)**

Identification of seal type is an important step towards proper maintenance. For mechanical seal types not shown, see the Seal Instruction Drawing (SID) furnished with the pump or contact a Viking representative.

SEAL REMOVAL

DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.**
2. **That the driving means (motor, turbine, engine, etc.) has been "locked out" or made non-operational so that it cannot be started while work is being done on pump.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

Failure to follow above listed precautionary measures may result in serious injury or death.

CARTRIDGE TYPE

Cartridge mechanical seals are designed so that they may be replaced with minimal pump and piping disassembly. The seal may be accessed by removing the bearing housing. **(See Disassembly, Steps 3-5, page 4).**

1. Remove any flush or barrier fluid tubes connected to the seal gland.
2. Loosen setscrews on the seal collar to free the cartridge seal from the shaft.
3. Remove the two gland capscrews and slide the cartridge seal out through the bearing housing opening.

If the pump is to be disassembled further, **refer to Disassembly, page 4.**

ELASTOMERIC BELLOWS AND PTFE WEDGE TYPE

Elastomeric bellows and PTFE wedge seals generally require pump disassembly to be replaced **(See Disassembly, steps 1-5, page 4).**

1. Loosen nuts and remove seal plate, seal plate holder, seal seat and seal gasket(s).
2. Loosen setscrew in set collar (bellows) or mechanical seal rotary member (wedge). **NOTE:** Piping and/or plugs will need to be removed to access setscrews.
3. The remainder of the mechanical seal may be removed in conjunction with Step 7 of **Disassembly, page 4.**

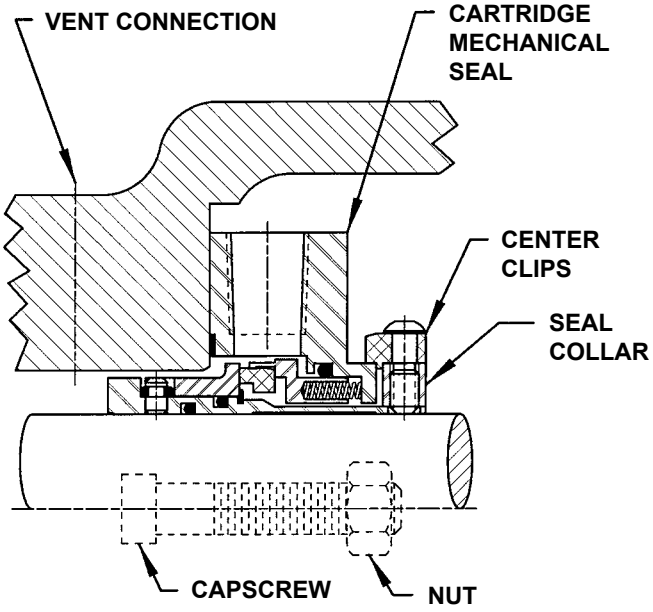
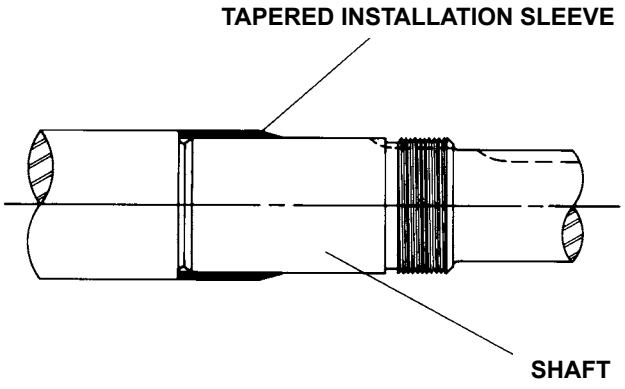


FIGURE 7
CARTRIDGE MECHANICAL SEAL

SEAL INSTALLATION



COAT ROTOR SHAFT, TAPERED INSTALLATION SLEEVE AND INNER DIAMETER OF MECHANICAL SEAL WITH LIGHT OIL BEFORE ASSEMBLY.

FIGURE 8

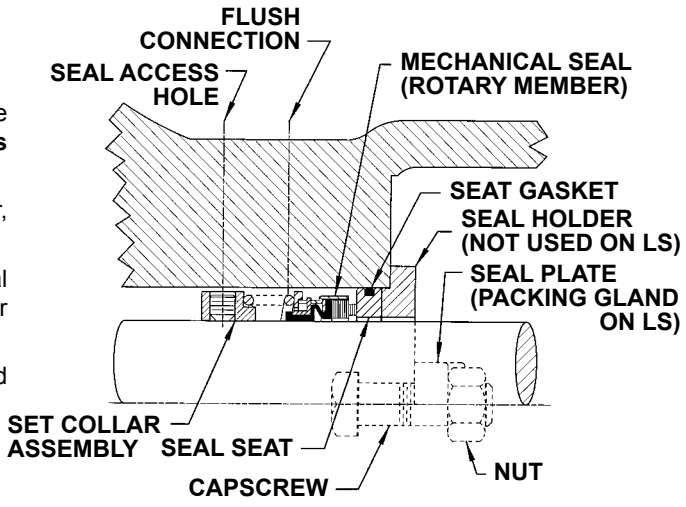


FIGURE 9
ELASTOMERIC BELLOWS SEAL

CARTRIDGE TYPE

1. **NOTE:** Burrs left on shaft can damage O-ring on seal sleeve during installation. Inspect shaft for burrs and remove any found with a fine grade of emery cloth.
2. Clean rotor shaft and face of seal chamber.
3. Place tapered installation sleeve on shaft. Coat rotor shaft, tapered installation sleeve, and O-ring in the inside diameter of cartridge seal sleeve with a generous amount of light oil. **Refer to Figure 8.**
4. Slide cartridge seal over installation sleeve on shaft until it contacts the seal chamber face. Remove tapered installation sleeve from shaft.
5. Follow steps 9-12 on **page 6** under **Assembly.**
6. Insert gland capscrews and secure gland to bracket face. **NOTE:** Turn shaft several turns while gland is loose to center seal; then tighten gland tight enough to compress gasket. Tighten only enough to contain leakage and not to distort gland.
7. Lock cartridge seal drive collar to shaft and remove or turn centering clips out of the way so as to clear the drive collar.
8. Turn shaft by hand or jog motor to check drive collar for runout.
9. Connect flush line or vent stuffing box seals without flush line until liquid is present on start up.

NOTE: For maximum seal life, flush line should be used.

DANGER !

Before starting pump, be sure all drive equipment guards are in place.

Failure to properly mount guards may result in serious injury or death.

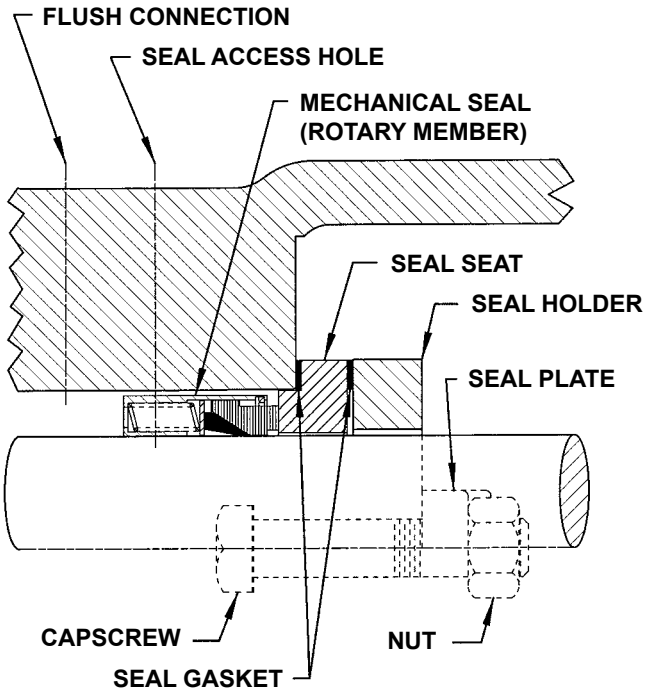


FIGURE 10
PTFE WEDGE SEAL

ELASTOMERIC BELLOWS AND PTFE WEDGE TYPE

For complete pump assembly instructions, **see Assembly, page 5.**

1. Clean rotor shaft and seal housing bore. Make sure they are free of dirt, grit and scratches. Gently radius leading edge of shaft diameter over which seal is to be placed.

   NOTE: Never touch mechanical seal faces with anything except clean hands or clean cloth. Minute particles can scratch the seal faces and cause leakage.

2. Place tapered installation sleeve on the shaft **(See Figure 11).**

3. Coat outside of tapered installation sleeve and inside of rotary member of the seal with a generous quantity of light oil. Grease is not recommended.

4. Start rotary member on shaft (including seat collar and screws on bellows seal) and ease over tapered sleeve **(See Figure 11).**

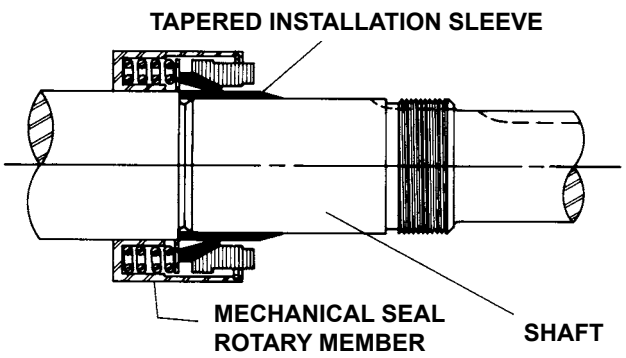


FIGURE 11

NOTE: Some PTFE wedge seals are equipped with holding clips, which compress the seal springs. Remove holding clips to release springs after seal is installed on shaft.

5. Move rotary member so set screws are directly below seal access holes on side of bracket **(See Figure 9, page 7 and Figure 10).** Tighten all setscrews securely to shaft.

   NOTE: Be sure that the rotor and shaft are positioned against the head before tightening set screws.

6. ***FOR "O-RING" GASKET TYPE MECHANICAL SEAL SEAT (BELLOWS SEAL):*** Lubricate outer diameter of O-ring seal gasket with oil. Flush sealing faces of both rotary member and seal seat with oil and press seal seat in to bore until back, unlapped face, is flush with bore. Install seal holder, seal plate, capscrews, and nuts and tighten securely.

   FOR "CLAMPED-IN" TYPE MECHANICAL SEAL SEAT (WEDGE SEAT): Flush sealing faces of both rotary member and seal seat with oil and install seal seat and seat gasket over end of shaft against machined bracket face. Install other seal gasket, seal holder, seal plate, capscrews and nuts and fasten securely.

7. Remove tapered installation sleeve.

8. Connect flush line or vent stuffing box for seals without flush line until liquid is present on start up.

   NOTE: For maximum seal life, flush line should be used.

   Refer to Assembly, page 5 to complete assembly.

THRUST BEARING ADJUSTMENT

1. Loosen the two set screws in the outer face of the bearing housing and turn this thrust bearing assembly clockwise until it can no longer be turned by hand. Back off counter-clockwise until the rotor shaft can be turned by hand with a slight noticeable drag.

2. For standard end clearance, back off the thrust bearing assembly the required length measured on the outside diameter of the bearing housing. **See Table 1, page 9.**

3. Tighten the two self-locking type "Allen" set screws, in the outboard face of the bearing housing, with equal force against the bracket. Your pump is now set with standard end clearances and locked.

   NOTE: Be sure the shaft can rotate freely. If not, back off additional length on outside diameter and check again.

4. High viscosity liquids required additional end clearances. The amount of extra end clearance depends on the viscosity of the liquid pumped. For specific recommendations, consult the factory. Table 1 shows the additional bearing housing adjustment required for .001" increase in end clearance.

PUMP SIZE	MODEL	STANDARD END CLEARANCE (Inch)	TURN BRG. HOUSING C.C.W. LENGTH ON O.D. (Inch)	ADDITIONAL LENGTH ON O.D. BRG. HOUSING FOR .001" END CL. (Inch)
LS	124A 4124A 126A 4126A 123A 4123A	.005	1.25	.25
	224A 224AH 4224A 4224AH 226A 4226A 223A 4223A 124E 124EH	.010	2.50	
	127A 4127A	.010	2.50	
	227A 4227A	.20	5.00	
Q QS	124A 4124A 126A 4126A 123A 4123A	.010	3.10	.31
	224A 4224A 226A 4226A 223A 4223A 124E	.015	4.65	
	127A 4127A	.010	3.10	
	227A 4227A	.020	6.20	

TABLE 1

INSTALLATION OF CARBON GRAPHITE BUSHINGS

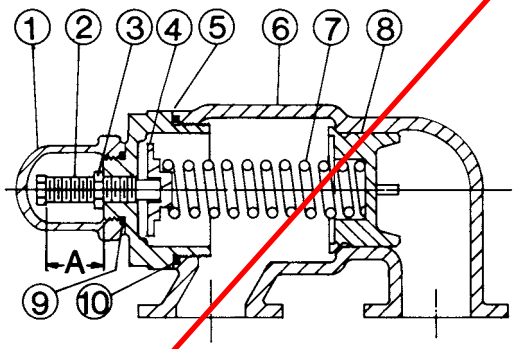
When installing carbon graphite bushings, extreme care must be taken to prevent breaking. Carbon graphite is a brittle material and easily cracked. If cracked, the bushing will quickly disintegrate. Using a lubricant and adding a chamfer on the bushing and the mating part will help in installation. The additional precautions listed below must be followed for proper installation.

1. A press must be used for installation.
2. Be certain bushing is started straight.
3. Do not stop pressing operation until bushing is in proper position. Starting and stopping will result in a cracked bushing.
4. Check bushing for cracks after installation.

Carbon graphite bushings with extra interference fits are frequently furnished for high temperature operation. These bushings must be installed by a shrink fit.

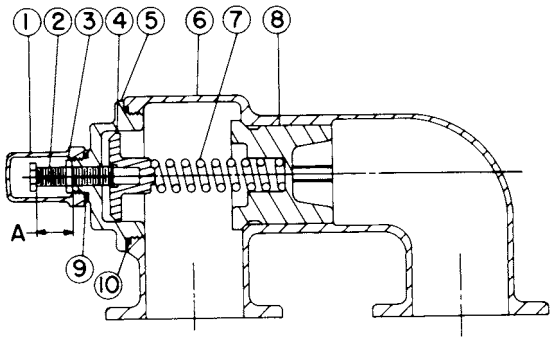
1. Heat bracket for idler to 750ºF.
2. Install cool bushing with a press.
3. If facilities are not available to reach 750ºF. temperature, it is possible to install with 450ºF. temperature; however the lower the temperature the greater the possibility of cracking the bushing.
4. Consult factory with specific questions on high temperature applications. **Refer to Engineering Service Bulletin ESB-3.**

PRESSURE RELIEF VALVE INSTRUCTIONS



VALVE - LIST OF PARTS			
1.	Valve Cap	6.	Valve Body
2.	Adjusting Screw	7.	Valve Spring
3.	Lock Nut	8.	Poppet
4.	Spring Guide	9.	Cap Gasket
5.	Bonnet	10.	Bonnet Gasket

FIGURE 12
SIZE LS



VALVE - LIST OF PARTS			
1.	Valve Cap	6.	Valve Body
2.	Adjusting Screw	7.	Valve Spring
3.	Lock Nut	8.	Poppet
4.	Spring Guide	9.	Cap Gasket
5.	Bonnet	10.	Bonnet Gasket

FIGURE 13
SIZES Q AND QS

DISASSEMBLY

Mark valve and head before disassembly to insure proper reassembly.

1. Remove valve cap.
2. Measure and record length of extension of adjusting screw. **Refer to "A" on Figure 12, page 9 and Figure 13.**
3. Loosen locknut and back out adjusting screw until spring pressure is released.
4. Remove bonnet, spring guide, spring and poppet from valve body. Clean and inspect all parts for wear or damage and replace if necessary.

ASSEMBLY

Reverse procedures outlined under Disassembly. If valve is removed for repairs be sure to replace in same position. Relief valve adjusting screw cap must always point towards suction side of pump. If pump rotation is reversed, remove relief valve and turn end for end.

PRESSURE ADJUSTMENT

If a new spring is installed or if pressure setting of pressure relief valve is to be changed from that which the factory has set, the following instructions must be carefully followed.

1. Carefully remove valve cap, which covers adjusting screw.
2. Loosen locknut (which locks adjusting screw so pressure setting will not change during operation of pump).
3. Install a pressure gauge in discharge line for actual adjusting operation.
4. Turn adjusting screw in to increase pressure and out to decrease pressure.
5. With discharge line closed at point beyond pressure gauge and pump running, gauge will show maximum pressure that the valve will allow (full bypass).

IMPORTANT

In ordering parts for pressure relief valve, always give model number and serial number of pump as it appears on nameplate and name of part wanted. When ordering springs, be sure to give pressure setting desired.

HEAT CARTRIDGES

ASSEMBLY

INSTALLATION INSTRUCTIONS:

WARNING !

The pump needs to be properly grounded before the heat cartridges are installed.

1. Spacers should be installed between the foot of the pump and the base. This will create an air gap between the pump and base to limit heat transfer to the base.
2. Coat the threads of the heat cartridge with an anti-seize compound prior to installation. Install heat cartridges into the tapped ports on the head and bracket in the locations shown in the Figure 13 below. Figure 13 also shows the minimum clearance around the pump needed to install and remove the heat cartridges as well as the location for the thermocouple. The number of heaters used and the total wattage for each pump size is given in Table 2 below. 3/8" heat cartridges should be tightened to 10ft-lbs. ½" and ¾" heat cartridges should be tightened to 20 ft-lbs.
3. Viking recommends installing a closed loop temperature controller with a control algorithm that will minimize or prevent overshooting the set point temperature. The set point temperature needs to be slightly higher than the melting point and significantly lower than the flash point or boiling point of the liquid being pumped. Viking does offer a controller for use with our heat cartridges. Ask your local Viking distributor for details.

WARNING !

Setting the set point temperature higher than necessary will not make the pump heat any faster and will shorten the life of the heat cartridges.

4. Properly insulate the pump to minimize heat loss. The pump will not heat properly if it is not insulated.

DANGER !

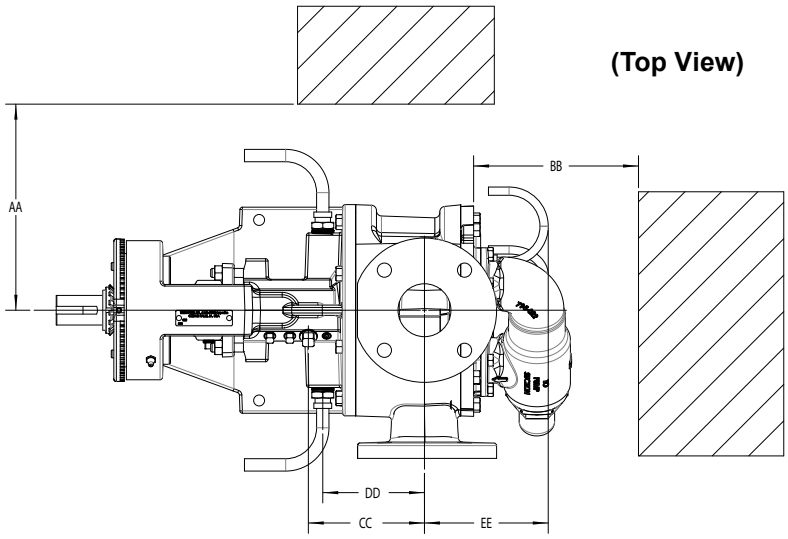
- **Always disconnect, lockout, and tag out supply circuits prior to installing.**
- **The installation must comply with standard and local regulations.**
- **All wiring should be done by a licensed electrician to meet local codes.**
- **Study this manual thoroughly before installing and using the heat cartridges.**
- **Pay special attention to this section and the parts marked "WARNING!" or "DANGER".**
- **Should questions or uncertainties arise, please contact your authorized Viking distributor.**

Failure to follow these instructions may cause an electrical shock and/or sparks, which may result in serious injury or death.

NOTE:

1. Heat cartridges, temperature probes, and controllers must be wired by a licensed electrician to meet local codes.
2. Heat cartridges require 240VAC, 1 Phase, 60 Hz or 220VAC, 1 Phase, 50 Hz power supply.
3. Heat cartridges are UL, CSA, & CE marked, RoHs compliant.
4. Heat cartridges and cables are water resistant but not water proof. They need to be installed in a protected area.
5. To make sure that the liquid within the pump is melted and to avoid damage to the pump, do not start the pump until the set point temperature has been reached.
6. Several factors such as the size of pump, the set point temperature, and the insulation will affect the amount of time it will take for the pump to reach the set point temperature. Typically it will take 3-4 hours for the pump to reach its set point temperature.
7. Do not use heat cartridges with different watt densities from those supplied by Viking. Changing watt densities may result in localized over or under heating.
8. The thermocouple or temperature probe must be installed in the bracket location shown in Figure 13 below. Any other location may result in localized over or under heating.
9. Please see TSM 630.4 for technical information on the Viking supplied controller for the heat cartridges.
10. The wires for the heat cartridges can be joined together in a junction box, and a single wire from the junction box can be connected to the controller.
11. **WARNING** Heat cartridges will be hot. Do not touch pump or heat cartridges until they have been allowed to cool.

Dimensions - LS through QS Sizes – Electrically Heated – Non Jacketed



Model	Bracket Heater to Port Center Line (DD)		Temp Probe to Port Center Line (CC)		Head Heater to Port Center Line (EE)		Required to Remove Heater (AA)		Required to Remove Heater (BB)	
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
LS124E	6.09	154.69	6.25	158.75	6.44	163.58	7.00	177.80	6.50	165.10
Q124E	5.83	148.08	7.33	186.18	8.25	209.55	9.25	234.95	7.75	196.85
QS124E	6.33	160.78	7.83	198.88	9.25	234.95				

FIGURE 13 - HEAT CARTRIDGE AND THERMOCOUPLE LOCATIONS

***** The thermocouple location for the LS size is located on the opposite side of the bracket as shown in the drawing.

Wattage by Pump Size			
Pump Size	Number of Heaters in Head	Number of Heaters in Bracket	Total Wattage
LS	2	2	1250
Q	3	2	2200
QS	3	2	2200

TABLE 2 - NUMBER OF HEAT CARTRIDGES IN EACH PUMP MODEL

VIKING PUMP

IDEX CORPORATION

WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. The warranty period for Universal Seal series pumps ONLY, shipped after July 1, 2001 (Universal Seal models listed below) is three (3) years from date of startup, provided that in no event shall this warranty extend more than forty-two (42) months from the date of shipment from Viking.

If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, FOB. Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources which are incorporated into any Viking product are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No officer or employee of IDEX Corporation or Viking Pump, Inc. is authorized to alter this warranty.

Universal Seal Pump Models: Sizes H, HL, K, KK, L, LQ, LL, LS, Q, QS, N, R and RS in Series 124A, 4124A, 124E, 4124E, 124EH, 4124EH, 4124AE, 4124B, 224A, 4224A, 224AH, 4224AH, 224AE, 4224AE, 4224B, 324A, 4324A, 126A, 4126A, 226A, 4226A, 123A, 4123A, 223A, 4223A, 323A, 4323A, 127A, 4127A, 227A, 4227A, 327A and 4327A.

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GEIGER

ENGINEERED ENVIRONMENTAL PRODUCTS FOR WATER AND WASTEWATER

April 25, 2012
Piscataway WWTP ENR Upgrade
Section: 11342 Carbon Recirculation Pumps

Recommended Spare Parts List

Part Number	Part Name	Quantity	Price
V42-129-00988005	Idler Bushing	1	$389.76 each*
V42-126-00388000	Bushing Bracket	1	$433.79 each*
V42-447-02263400	Idler Pin	1	$1,356.43 each*
V42-477-30499900	Mechanical Seal	1	$2,099.24 each*

Geiger Pump & Equipment Company
8924 Yellow Brick Road
Baltimore MD, 21237
Phone: 410-682-2660
Fax: 410-682-4750

Prices Subject to Change

VIKING PUMP

Section **R630.48**

Viking Effective Date 05/30/08

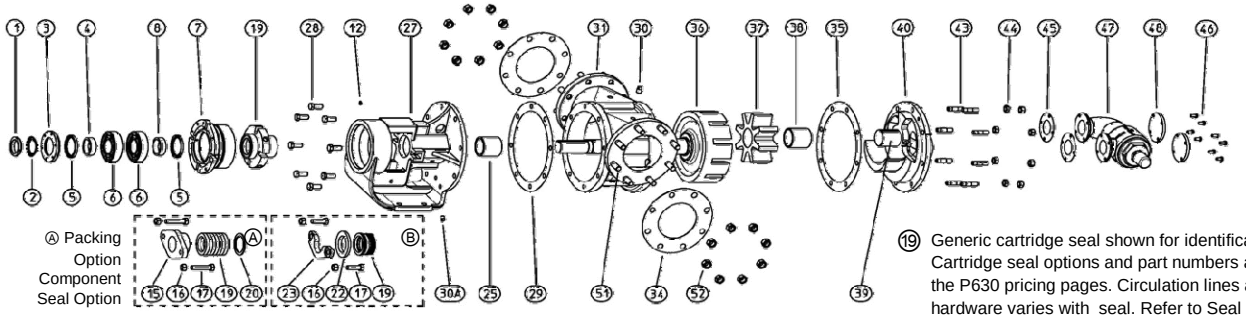
Distributor Print Date ec

Quoting Distributor:

MODELS QS127A, QS4127A
QS227A, QS4227A

Subject to Change without notice. F.O.B. Cedar Falls

Part numbers provided by Viking Pump are standard parts or options for this model. Any modifications to part numbers or pricing made to this document are the responsibility of the authorized Viking distributor. It is recommended that the pump serial number be provided for verification of actual part numbers required for a specific pump.



⑲ Generic cartridge seal shown for identification. Cartridge seal options and part numbers are located in the P630 pricing pages. Circulation lines and mounting hardware varies with seal. Refer to Seal Installation Drawings or pump serial number for part numbers.

ITEM	PART NO.	DESCRIPTION	MATERIAL
1	2-507-009-375-00	Locknut, #N-11	Steel
2	2-807-010-375-00	Lockwasher, #TW-111	Steel
3	2-140-055-100-00	End Cap for Bearing Housing	Iron
4	2-288-054-295-00	Bearing Spacer Collar (Outer)	Steel
5	2-283-031-378-00	Lip Seal (2 Req'd)	Buna-N
6	2-056-016-375-00	Roller Bearing (2 Req'd)	Steel
7	2-060-033-722-00	Bearing Housing	Aluminum
8	2-288-054-295-00	Bearing Spacer Collar (Inner)	Steel
12	2-469-002-376-00	Grease Fitting, 1/8" NPT (Straight) (2 Req'd)	Steel
15	2-525-015-630-00	Packing Gland	Stainless Steel
16	2-505-009-610-00	Packing/Seal Gland Nut, 5/8" NC Self Locking (2 Req'd)	Stainless Steel
17	2-151-003-610-00	Packing/Seal Gland Capscrew, 5/8" NC 3" Lg. (2 Req'd)	Stainless Steel
19	2-520-018-830-00	Packing (7 Req'd)	Standard
	2-480-028-999-00	Mechanical Seal (Complete)	PTFE
20	2-805-034-630-00	Packing Retaining Washer	Stainless Steel
22	2-527-083-630-00	Seal Holder	Stainless Steel
23	2-527-042-630-00	Seal Holder Plate	Stainless Steel
25	2-126-003-880-00	Bracket Bushing	Carbon Graphite
	2-126-003-880-05	Bushing for Jacketed Bracket	Carbon Graphite
27	3-079-356-700-00	Bracket and Bushing	Stainless Steel/Carbon Graphite
	3-079-368-700-05	[1] Jacketed Bracket and Bushing	Stainless Steel/Carbon Graphite
28	2-151-025-610-00	Capscrew for Bracket, 5/8" NC 1-1/2" Lg. (8 Req'd)	Stainless Steel
29	2-314-003-806-15	Bracket Gasket	Standard
30	2-542-010-610-00	Pipe Plug - 3/8" (1 Req'd)	Stainless Steel
30A	2-542-004-610-00	Pipe Plug - 1/4" (4 Req'd)	Stainless Steel
31	2-234-084-630-00	Casing	Stainless Steel
34	2-314-006-806-62	Pipe Flange Gasket (2 Req'd)	Standard
35	2-314-003-806-15	Head Gasket	Standard
36	3-575-300-724-47	[2] Rotor and 22-1/4" Shaft, "B" Dimension 4-1/2" with 1/2" x 4-3/8" Key on End	Stainless Steel/Stainless Steel
	3-575-300-724-67	[2] Rotor and 22-1/4" Shaft, "B" Dimension 4-1/2" with 1/2" x 4-3/8" Key on End for Jacketed Pumps	Stainless Steel/Stainless Steel
37	3-422-303-701-75	Idler and Bushing Assembly	Stainless Steel/Carbon Graphite

VIKING PUMP

Section **R630.48**

Viking Effective Date 05/30/08

Distributor Print Date ec

Quoting Distributor:

MODELS QS127A, QS4127A
QS227A, QS4227A

Subject to Change without notice. F.O.B. Cedar Falls

38	2-129-043-880-05	Idler Bushing	Carbon Graphite
39	2-447-036-634-00	Idler Pin, Lube	Coated Stainless Steel
40	3-391-302-784-00	Head (Valve Type used with Cover Plates when Less Valve) and Lube Idler Pin Assembly	Stainless Steel/Coated Stainless Steel
	3-392-301-70P-00	[1] Head (Jacketed) and Lube Idler Pin Assembly	Stainless Steel/Coated Stainless Steel
43	2-782-007-610-00	Stud for Head, 5/8" NC 2-1/4" Lg. (8 Req'd)	Stainless Steel
44	2-503-012-610-00	Nut for Head, 5/8" NC (8 Req'd)	Stainless Steel
45	2-308-009-806-15	Relief Valve or Cover Plate Gasket (2 Req'd)	Standard
46	2-150-032-610-00	Capscrew 3/8" NC 3/4" Lg. For Valve or Cover Plates (8 Req'd)	Stainless Steel
47	3-795-830-000-00	Internal Relief Valve - High Temp. (Complete)	Stainless Steel
48	2-294-206-630-00	Cover Plate (For Plain Head Pump) (2 Req'd)	Stainless Steel
†51	2-782-047-610-00	Stud for Flanges, 3/4" NC 3-1/4" Lg. (16 Req'd)	Stainless Steel
52	2-503-013-610-00	Nut for Flanges, 3/4" NC (16 Req'd)	Stainless Steel
56	3-463-057-999-00	[1] Circulation Line Assembly (assembled standard as Suck Back for component mechanical seals, or Flush for packing) ⑲	Stainless Steel
1 thru 8	3-060-078-999-00	Bearing Housing Assembly (Complete)	Aluminum
	2-596-004-375-00	[1, 3] Bearing Housing Set Screw 5/16" NC 5/16" Lg. (2 Req'd)	Steel
	2-490-008-902-00	[1, 3] Insert 1/4" O.D. x 1/8" (2 Req'd). Used with End Cap Set Screw	Nylon
	2-596-029-375-00	[1, 3] End Cap Set Screw 3/8" NC 3/4" (2 Req'd)	Steel

Miscellaneous Notes

1. Not illustrated.
2. When ordering a rotor and shaft, see instruction on sample order sheet in Section R000 of repair parts catalog or TR901.
3. Included in Bearing Housing Assembly Kit.

The following trademarked materials may be used on any product:
Aflas® - Registered Trademark of Asahi Glass Co. Ltd.
PPS - Reinforced polyphenylene sulfide.
Viton® - Registered Trademark of DuPont Performance Elastomers.

When ordering parts be sure to give PART NUMBER, NAME OF PART, MATERIAL, MODEL & SERIAL NO. of the pump as it appears on nameplate.

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† Changed or added since 5/08

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Section 11342: Viking Carbon Recirculation Pumps
Section 3: Motor O&M Manual

BALDOR • RELIANCE

Integral Horsepower
AC Induction Motors

Installation & Operating Manual

2/09 MN400

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Section 1
General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements.
A Warning statement indicates a possible unsafe condition that can cause harm to personnel.
A Caution statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

Limited Warranty

www.baldor.com/support/warranty_standard.asp

Safety Notice: This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

WARNING: **Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.**

WARNING: **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.**

WARNING: **Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.**

WARNING: **Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**

WARNING: **This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.**

WARNING: **Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.**

WARNING: **Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.**

WARNING: **Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.**

WARNING: **Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.**

WARNING: **Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

Safety Notice Continued

WARNING: **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

WARNING: **Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.**

WARNING: **Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.**

WARNING: **Use only UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust.**

WARNING: **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.**

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Caution: **To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.**

Caution: **Do not over–lubricate motor as this may cause premature bearing failure.**

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

Caution: **If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

Caution: **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

Caution: **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.**

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.
2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
3. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.

4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation.

   Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Storage

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate “shell” should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the “shell”.

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, which ever is greater. Minimum resistance is calculated as follows: **Rm = kV + 1**

where: (Rm is minimum resistance to ground in Meg−Ohms and
kV is rated nameplate voltage defined as Kilo−Volts.)

Example: For a 480VAC rated motor Rm =1.48 meg−ohms (use 5 MΩ).
For a 4160VAC rated motor Rm = 5.16 meg−ohms.

Preparation for Storage

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
   a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
   b. Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.
   c. Relative humidity must not exceed 60%.
   d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

   Note: Remove motor from containers when heaters are energized, reprotect if necessary.
3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
   a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
   b. Place new desiccant inside the vapor bag and re−seal by taping it closed.
   c. If a zipper−closing type bag is used instead of the heat−sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
   d. Place the shell over the motor and secure with lag bolts.
4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.

5. Motors with anti−friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
   a. Motors marked “Do Not Lubricate” on the nameplate do not need to be greased before or during storage.
   b. Ball and roller bearing (anti−friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
   c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.
   d. “Provisions for oil mist lubrication” − These motors are packed with grease. Storage procedures are the same as paragraph 5b.
   e. “Oil Mist Lubricated” − These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under “Standard Condition” in Section 3, then rotate the shaft 15 times by hand.
6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic “T” drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.

Non−Regreaseable Motors

Non−regreasable motors with “Do Not Lubricate” on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

All Other Motor Types

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreasable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

Removal From Storage

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

Section 2
Installation & Operation

Overview Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip−Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non−corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

Hazardous Locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

Mounting The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Alignment Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. **Direct Coupling**
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. **End-Play Adjustment**
   The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. **Pulley Ratio**
   The pulley ratio should not exceed 8:1.

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

4. **Belt Drive**
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.
5. Sleeve bearing motors are only suitable for coupled loads.

Doweling & Bolting After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.

Guarding Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

Power Connection Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

Conduit Box For ease of making connections, an oversize conduit box is provided.
The box can be rotated 360° in 90° increments.
Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
   OR
2. AC power is within ±5% of rated frequency with rated voltage.
   OR
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-2.

Figure 2-1 Accessory Connections

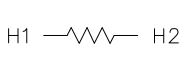
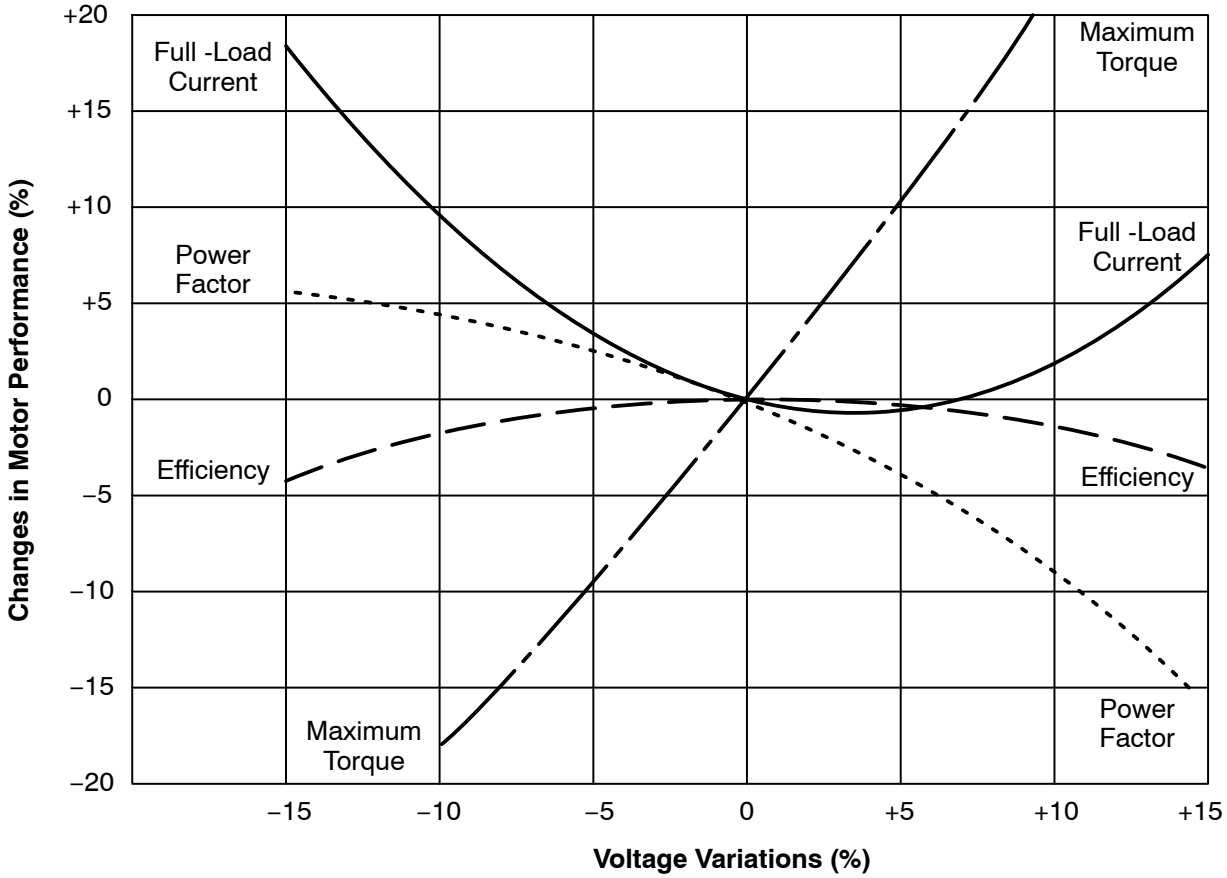
HEATERS 	One heater is installed in each end of motor. Leads for each heater are labeled H1 & H2. (Like numbers should be tied together).
THERMISTORS 	Three thermistors are installed in windings and tied in series. Leads are labeled T1 & T2.
WINDING RTDS 	Winding RTDs are installed in windings (2) per phase. Each set of leads is labeled W1, W2, W3, W4, W5, & W6.
BEARING RTD 	* One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE. * One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE. * Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead.

Figure 2-2 Typical Motor Performance VS Voltage Variations



Rotation All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn−to−turn, phase−to−phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

First Time Start Up Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

Coupled Start Up This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor District Office or Baldor Service Center.

Section 3
Maintenance & Troubleshooting

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is **Polyrex EM (Mobil)**. Do not mix greases unless compatibility has been checked and verified.

Equivalent and compatible greases include:
Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.

Relubrication Intervals Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 5800 incl. (300)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<–29° C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in^3	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–450)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–450)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over−lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over−lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as "Severe".
3. Table 3-4 shows that 1.2 in^3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Table 3-5 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings.
		Tighten “Thru Bolts”.
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $^3/_4$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $^3/_4$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.

Suggested bearing and winding RTD setting guidelines

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Motor Load	Class B Temp Rise ≤ 80°C (Typical Design)		Class F Temp Rise ≤ 105°C		Class H Temp Rise ≤ 125°C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod–Express.
• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Bearing Type Oil or Grease	Anti–Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants) include the following:

- Texaco Polystar
- Rykon Premium #2
- Chevron SRI #2
- Mobilith SHC–100
- Pennzoil Pennzlube EM–2
- Chevron Black Pearl
- Darmex 707
- Darmex 711
- Petro–Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.
Contact Baldor application engineering for special lubricants or further clarifications.

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MN400
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Section 11342: Viking Carbon Recirculation Pumps
Section 4: Reducer O&M Manual

VIKING PUMP

TECHNICAL SERVICE MANUAL

Viking® In-Line Helical Gear Reducers

Sizes 11, 21, 31, 35, 41, 51, 61, 70, 80, 90, 100

SECTION	TSM 615
PAGE	1
ISSUE	D

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Periodic Oil Changes	
Plug Location	3
Radial and Overhung Loads	3
Repair Parts Information	4
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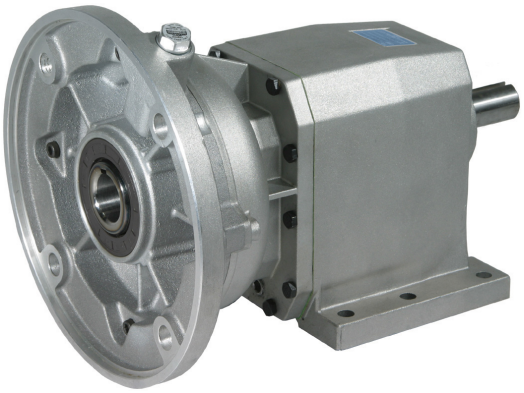


FIGURE 1
SIZE 21 WITH NEMA C-FACE ADAPTOR

INTRODUCTION

The illustrations used in this manual are for identification purposes only. Repair kit numbers are listed in this manual on page 4. When ordering repair parts, always give the complete name of part, and part number.

FIGURE 2
SIZE 31 WITH SOLID INPUT SHAFT

DANGER !

Before removing any Viking reducer from its unit be sure: that the driving means (motor, turbine, engine, etc.) has been "locked out" or made non-operational so that it cannot be started while work is being done on the reducer or driven equipment.

Failure to follow above listed precautionary measures may result in serious injury or death.

DANGER!

Incorrect installation, operation or maintenance of equipment may cause severe personal injury or death and/or equipment damage.

This information must be read fully before beginning installation, operation or maintenance and must be kept with the reducer. It is suggested that suitably trained or qualified persons perform all installation and maintenance procedures.

Caution !

To avoid oxidation and possible seizure of the motor shaft to the NEMA-C or IEC motor flange adaptor bore, apply an anti-seize product to the motor shaft prior to assembly.

LUBRICATION

Gear units are oil-bath lubricated. For applications calling for speed reducers with vertical shaft orientation, oil coverage during operation would not be sufficient to ensure correct lubrication of upper bearings, suitable life lubrication systems must be used.

Speed reducer sizes 11 - 41 are supplied pre-filled with oil and do not have oil filling or level plugs. These long-life lubricated units (using synthetic oil) are capable of operating at an ambient temperature range of 32°F (0°C) to 122°F (50°C). For temperatures below 32°F (0°C), contact your authorized distributor or Viking Technical Service.

Speed reducers sizes 51 - 100 require oil filling by the user. Before start-up, fill with the correct quantity of oil, selecting the viscosity levels using Tables 1 and 2. These speed reducers are supplied with oil fill, level, and drain plugs.

Contact your authorized distributor or Viking Technical Service for vertical or other mounting arrangements

Size	Oil Quantity	
	Pints	**Liters**
11 *	0.95	.45
21 *	1.69	0.80
31 *	3.0	1.4
35 *	3.4	1.6
41 *	4.6	2.2
51	6.6	3.1
61	8.9	4.2
70	14	6.5
80	23	11
90	40	19
100	57	27

* Indicates Life Lubricated

TABLE 1

Ambient Temperature

	32 – 70° F (0 – 20°C)		70 – 104° F (20 – 40°C)	
Duty Load	Mineral Oil **ISO VG**	Synthetic Oil **ISO VG**	Mineral Oil **ISO VG**	Synthetic Oil **ISO VG**
Light Duty	150	150	220	220
Medium Duty	150	150	320	220
Heavy Duty	220	220	460	320

TABLE 2

Periodic Oil Changes

Periodic oil changes are not required for sizes 11 - 41 as they are lubricated for life with synthetic oil. The remaining sizes 51 – 100 are designed for oil lubrication and have oil fill, level, and drain plugs. Users should fill the units with oil using Table 1 with the correct quantity.

It must be emphasized that these quantities are only indicative and users should check the correct level through the sight glass.

CAUTION !

Sizes 11, 21, 31, 35, 41 are pre-filled with synthetic lubricant when shipped and require no additional lubricant. These sizes have no oil filling or level plugs. Sizes 51 – 100 require filling with correct amount and type of lubricant prior to use. Operating reducer without the proper type and amount of lubricant for even a short period of time may cause damage.

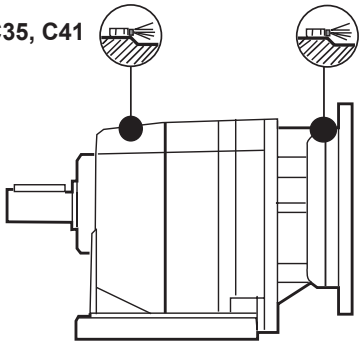
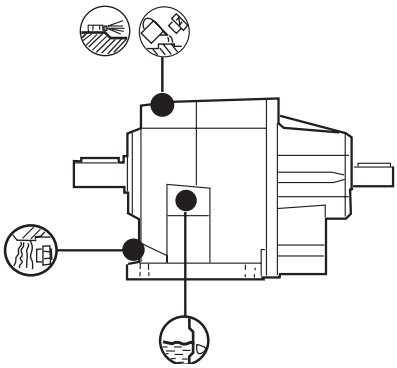
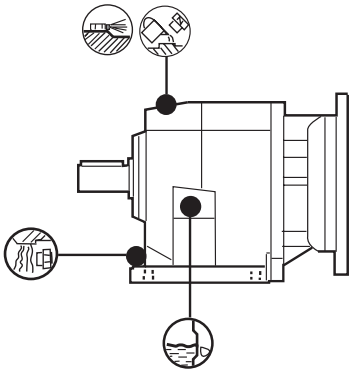
Oil Change Interval (hrs)

Oil Temperature	Mineral Oil	Synthetic Oil
<150° F (<65°C)	8000	25000
150-175°F (65 – 80°C)	4000	15000
175–200°F (80–95°C)	2000	12500

TABLE 3

PLUG LOCATIONS

The breather plug, fill/breather plug, level plug and drain plug locations are shown below. The C11-C41 reducers are filled and shipped with a synthetic oil and, therefore, do not have fill or level plugs. The C51-C100 reducers must be filled at installation and have a level plug mounted on the side. The plug locations are shown below.

<table>
<tr><th></th><th>HS</th><th>NEMA and IEC</th></tr>
<tr><td>C11- C41</td><td>C-11 C35, C41 C21, C31</td><td>C35, C41
  </td></tr>
<tr><td>C51-C61</td><td>  </td><td>  </td></tr>
<tr><td>C70-C100</td><td></td><td>Symbols
/
Sight Glass</td></tr>
</table>

RADIAL AND OVERHUNG LOADS

Input and output shaft of the speed reducer can be subject to loading generated by the type of transmission fitted on the shaft itself. Acceptable overhung load levels can be calculated. Contact your Authorized Distributor or Viking Technical Support for assistance.

REPAIR PARTS

Special tools and training are required to repair multi-reduction gearboxes. Replacement of gears, shafts and bearings, combined with labor makes repairs impractical.

Repair parts for in-line reducers are limited to seal kits consisting of oil seals and gaskets. The table below lists the part number for the repair kit for each reducer size and configuration.

Size	Input Shaft	Repair Kit No.
11	Solid Shaft	3-462-ILINE11-001
	56C	3-462-ILINE11-002
	143/145TC	3-462-ILINE11-003
	182/184TC	3-462-ILINE11-004
	63 IEC	3-462-ILINE11-005
	71 IEC	3-462-ILINE11-006
	80 IEC	3-462-ILINE11-007
	90 IEC	3-462-ILINE11-008
	100/112 IEC	3-462-ILINE11-009
21	Solid Shaft	3-462-ILINE21-001
	56C	3-462-ILINE21-002
	143/145 TC	3-462-ILINE21-003
	182/184 TC	3-462-ILINE21-004
	63 IEC	3-462-ILINE21-005
	71 IEC	3-462-ILINE21-006
	8O IEC	3-462-ILINE21-007
	90 IEC	3-462-ILINE21-008
	100/112 IEC	3-462-ILINE21-009
31	Solid Shaft	3-462-ILINE31-001
	143/145 TC	3-462-ILINE31-002
	182/184 TC	3-462-ILINE31-003
	80 IEC	3-462-ILINE31-004
	90 IEC	3-462-ILINE31-005
	100/112 IEC	3-462-ILINE31-006
35	Solid Shaft	3-462-ILINE35-001
	143/145 TC	3-462-ILINE35-002
	182/184 TC	3-462-ILINE35-003
	213/215 TC	3-462-ILINE35-004
	80 IEC	3-462-ILINE35-005
	90 IEC	3-462-ILINE35-006
	100/112 IEC	3-462-ILINE35-007
	132 IEC	3-462-ILINE35-008
41	Solid Shaft	3-462-ILINE41-001
	143/145 TC	3-462-ILINE41-002
	182/184 TC	3-462-ILINE41-003
	213/215TC	3-462-ILINE41-004
	80 IEC	3-462-ILINE41-005
	90 IEC	3-462-ILINE41-006
	100/112 IEC	3-462-ILINE41-007
	132 IEC	3-462-ILINE41-008
51	Solid Shaft	3-462-ILINE51-001
	182/184 TC	3-462-ILINE51-002
	213/215 TC	3-462-ILINE51-003
	254/256 TC	3-462-ILINE51-004
	284/286 TC	3-462-ILINE51-005
	100/112 IEC	3-462-ILINE51-006
	132 IEC	3-462-ILINE51-007
	160 IEC	3-462-ILINE51-008
	180 IEC	3-462-ILINE51-009
61	Solid Shaft	3-462-ILINE61-001
	182/184 TC	3-462-ILINE61-002
	213/215TC	3-462-ILINE61-003
	254/256 TC	3-462-ILINE61-004
	284/286 TC	3-462-ILINE61-005
	100/112 IEC	3-462-ILINE61-006
	132	3-462-ILINE61-007
	160	3-462-ILINE61-008
	180	3-462-ILINE61-009
70	Solid Shaft	3-462-ILINE70-001
80	Solid Shaft	3-462-ILINE80-001
90	Solid Shaft	3-462-ILINE90-001
100	Solid Shaft	3-462-ILINE100-001

VIKING PUMP

IDEX CORPORATION

WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, FOB. Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources which are incorporated into any Viking product are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No officer or employee of IDEX Corporation or Viking Pump, Inc.. is authorized to alter this warranty.

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Section 11342: Viking Carbon Recirculation Pumps
Section 5: Coupling Installation

SURE-FLEX® COUPLINGS

TB Wood's

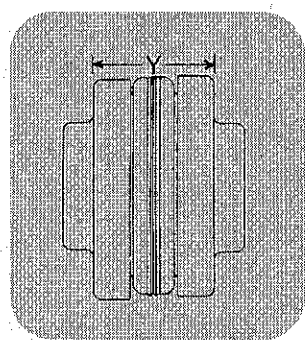
Installation Instructions

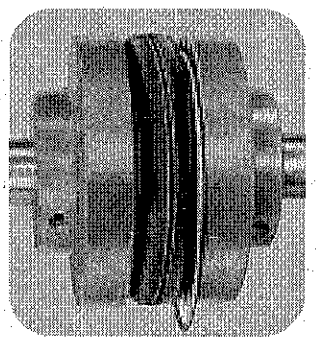
Sure-Flex flanges (outer metallic parts) and sleeves (inner elastomeric members) come in many sizes and types. First, determine the size and type of components being used. Remove all components from their boxes, and loosely assemble the coupling on any convenient surface. (Do not attempt to install the wire ring on the two-piece E or N sleeve at this time.) Also check maximum RPM values in the table against operating speed. All rubber sleeves (EPDM and Neoprene) have the same ratings for a given size and may be used interchangeably. However, because rubber and Hytrel sleeves have completely different ratings, they never should be used interchangeably.

1 Inspect all coupling components and remove any protective coatings or lubricants from bores, mating surfaces and fasteners. Remove any existing burrs, etc. from the shafts.

2 Slide one coupling flange onto each shaft, using snug-fitting keys where required. When using Type B flanges, follow the instructions furnished with the Sure-Grip bushing.

3 Position the flanges on the shafts to approximately achieve the Y dimension shown in the table. It is usually best to have an equal length of shaft extending into each flange. Move one flange to its final position. Torque fasteners to proper values. Slide the other flange far enough away to install the sleeve. With a two-piece sleeve, do not move the wire ring to its final position; allow it to hang loosely in the groove adjacent to the teeth.

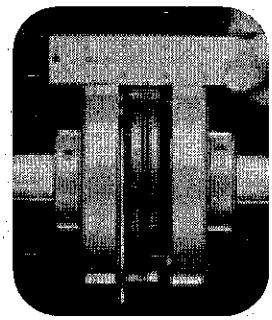




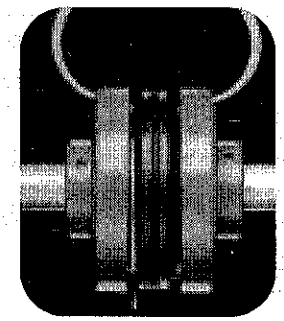
4 Slide the loose flange on the shaft until the sleeve is completely seated in the teeth of each flange. (The "Y" dimension is for reference and not critical.) Secure the flange to the shaft. Different coupling sleeves require different degrees of alignment precision. Locate the alignment values for your sleeve size and type in the table.

5 Check parallel alignment by placing a straight-edge across the two coupling flanges and measuring the maximum offset at various points around the periphery of the coupling without rotating the coupling. If the maximum offset exceeds the figure shown under "Parallel" in the table, realign the shafts.

6 Check angular alignment with a micrometer or caliper. Measure from the outside of one flange to the outside of the other at intervals around the periphery of the coupling. Determine the maximum and minimum dimensions without rotating the coupling. The difference between the maximum and minimum must not exceed the figure given under "Angular" in the table. If a correction is necessary, be sure to recheck the parallel alignment.



Parallel



Angular

MAXIMUM RPM AND ALLOWABLE MISALIGNMENT

(Dimensions in inches)

Sleeve Size	Maximum RPM	Types JE, JN, JES, JNS, E & N			*Type H & HS		
		Parallel	Angular	Y	Parallel	Angular	Y
3	9200	.010	.035	1.188	...	...	...
4	7600	.010	.043	1.500	...	...	...
5	7600	.015	.056	1.938	...	...	...
6	6000	.015	.070	2.375	.010	.016	2.375
7	5250	.020	.081	2.563	.012	.020	2.563
8	4500	.020	.094	2.938	.015	.025	2.938
9	3750	.025	.109	3.500	.017	.028	3.500
10	3600	.025	.128	4.063	.020	.032	4.063
11	3600	.032	.151	4.875	.022	.037	4.875
12	2800	.032	.175	4.688	.025	.042	5.688
13	2400	.040	.195	6.688	.030	.050	6.625
14	2200	.045	.242	7.750	.035	.060	7.750
16	1500	.062	.330	10.250	...	...	...

Note: Values shown above apply if the actual torque transmitted is more than 1/4 the coupling rating. For lesser torque, reduce the above values by 1/2.

*Type H and HS sleeves **should not** be used as direct replacements for EPDM or Neoprene sleeves.

7 If the coupling employs the two-piece sleeve with the wire ring, force the ring into its groove in the center of the sleeve. It may be necessary to pry the ring into position with a blunt screwdriver.

8 Install coupling guards per OSHA requirements.

CAUTION: Coupling sleeves may be thrown from the coupling assembly with substantial force when the coupling is subjected to a severe shock load or abuse.

Section 11342: Viking Carbon Recirculation Pumps
Section 6: Submittal

Project:
Piscatway WWTP ENR Upgrade
Accokeek, MD 20607

X1348CB1
Rev. 1

Submittal Package

Section 11342: Carbon Recirculation Pumps

Prepared For:
Norair Engineering Corp.
337 Brightseat Road
Landover, MD 20785
Purchase Order No. 2321-101

June 16, 2011

Local Representative:

Geiger Pump & Equipment Co.
8924 Yellow Brick Road
Baltimore, Maryland 21237
Telephone: (410) 682-2660
Fax: (410) 682-4750

GEIGER

Geiger Pump & Equipment
830 Tyrens Road
Aston, PA 19014
Ph.410-459-1212
Fax 410-459-3992
info@geigerinc.com

Submittal Response

June 16, 2011

WSSC Piscataway WWTP ENR Upgrade, Contract #CD4258A05
Submittal response by: Geiger Inc.

Response to Submittal: 11342-01, Carbon Recirculation Pumps.

1. No action required.
2. Revised submittal includes performance curves for all fluid conditions.
3. Revised submittal includes provision of 15 Hp motors. Curves included per #2 above, demonstrate maximum power required at highest viscosity is 12.2 Hp.
4. No action required.
5. Comply. Baseplates will be appropriately painted.
6. Revised submittal includes control panel information.
7. Geiger will provide manufacturer's field service as specified in 11342.3.3.

Karen Klingler - 2321, Piscataway WWTP ENR - Construction - Carbon Recirculation Pumps - CLOSED

From: "Henry Cassi" <HCassi@Norair.com>
To: "Chris Brown" <cbrown@geigerinc.com>, "Rebekah Macko" <rmacko@geigerinc.com>
Date: 4/15/2011 2:56 PM
Subject: 2321, Piscataway WWTP ENR - Construction - Carbon Recirculation Pumps - CLOSED
CC: "Linda Emery" <LEmery@Norair.com>

Chris, Rebekah,

Carbon Recirculation Pumps have been APPROVED AS NOTED, RESUBMIT. Please review the comments and respond. When can we have the resubmittal along with the panel drawing?

Henry Cassi
Norair Engineering Corp.
301-499-2202

From: e-Builder Network Notification Server [mailto:bounces@e-builder.net]
Sent: Friday, April 15, 2011 2:30 PM
To: Henry Cassi
Subject: FYI - Piscataway WWTP ENR - Construction - Carbon Recirculation Pumps - CLOSED

Piscataway WWTP ENR - Construction

FYI - This form is CLOSED
To view details or take action on this item, click here

Form:	***SUBMITTAL #11342-01 - 34**
Subject:	**Carbon Recirculation Pumps**
Author:	**Rosita Cowan**
Date Created:	**3/17/2011 5:38:38 PM Eastern Time**
Held By:	**Rosita Cowan**
Date Due:	**04.15.2011**
Date Closed:	**4/15/2011 2:30:10 PM Eastern Time**
Item(s) Being Submitted:	**Carbon Recirculation Pumps**
Subcontractor / Vendor / Manufacturer Contact Information:	**Christopher Brown Geiger Pump & Equipment Co. 8924 Yellow Brick Road Baltimore, MD 21237 Phone 410-682-2660 x1105 Fax 410-682-4750**
Discipline:	**Process Mechanical**
Specification Section:	**11342**
Paragraph:	**None**
Contract Drawing Reference(s):	**M-2, M-3**
We Are Sending:	**Attached (Electronic Version)**

☐ **As-Builts**
☐ **Calculations**

The Following Items:

- ☐ **Construction/Layout Drawings**
- ☐ **O & M Manuals**
- ☐ **Product/Technical Data**
- ☐ **Reports/Certifications**
- ☐ **Samples/Color Charts**
- ☐ **Schedule**
- ☑ **Shop Drawings**
- ☐ **Spare Parts**
- ☐ **Specifications**
- ☐ **Training-Related Information**
- ☐ **Other (see below)**

Submitted For: **Approval**

Contractor's Remarks: **None**

CONTRACTOR'S CERTIFICATION STATEMENT: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and pertinent data, and I have checked and coordinated each item with other applicable approved drawings and all Contract requirements.

WSSC's Project Manager, Engineer or Authorized Agent - Complete This Section

Review Status:

- ☐ **Approved**
- ☐ **Approved As Noted**
- ☑ **Approved As Noted - Resubmit**
- ☐ **For Information Only**
- ☐ **Accepted As Noted**
- ☐ **Accepted As Noted - Resubmit**
- ☐ **Rejected**
- ☐ **Not Reviewed**

Submittal Review Comments:

1. The proposed pump model by 2nd listed manufacturer Viking, is an internal gear type positive displacement pump, rather than an external gear as specified based on the 1st listed manufacturer (Tuthill HD 330). The proposed internal gear type is acceptable (11342, 2.2.A, and 2.3.A.1).

2. The submitted pump curve lists a viscosity of 449.2 cP at 70 degrees, and a specific gravity of 1. The carbon recirculation pumps shall be capable of handling any and all of the specified process fluids; some are of high viscosity and some have specific gravity greater than 1. Please resubmit curves for the proposed pump based on the most conservative conditions for this project (11342, 2.2.C, and 2.4.A).

3. In conjunction with the previous comment, confirm motor horsepower selection for the conditions required for this project. The contract requires a 20 HP motor for pumping high viscosity fluids; 10 HP is proposed in this submittal (11342, 2.3.A.5). All deviations from the contract documents should clearly be noted on all submittals.

4. The submitted spare parts will not be able to be approved until the O&M is submitted. The O&M will show the recommended spare parts list with recommended quantities as well as manufacturer's prices.

5. Unmounted pumps along with a modified structural steel base have been submitted. Base will need to be coated to withstand its environment.

6 The submittal does not include the pump control panel that is to be supplied by the pump manufacturer per 11342, 2.6.

7. The submittal does not address requirements for manufacturer's field services 11342, 3.3.

Approval, corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with requirements of the drawings and specifications. This check is only for review of general compliance with the information given in the contract documents. The Contractor is responsible for continuing and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of other trades; and performing his work in a safe and satisfactory manner.

WSSC Authorized Representative: **Renato Nojadera, Project Manager - 4/15/2011**

Files Attached (1): **2321 Trans #133 Submittal 11342-01 Carbon Recirculation Pumps.pdf**

Comments (Newest First)

Renato Nojadera from *WSSC* added a comment at 4/15/2011 2:30:10 PM Eastern Time

By : Renato Nojadera - WSSC

Form closed and placed back in the author's court.

Renato Nojadera from *WSSC* held this form for 0.26 days as of 4/15/2011 2:10:03 PM Eastern Time

By : Renato Nojadera - WSSC
To : Rosita Cowan - Norair Engineering Corp.
CC : Henry Cassi, Simon Jimenez, Mechanical Submittal Review

This submittal is "Approved as Noted, Resubmit". Please refer to the submittal review comments.

Laura Knox from *O'Brien & Gere Engineers, Inc.* held this form for 20.38 days as of 4/15/2011 12:02:56 PM Eastern Time

By : Laura Knox - O'Brien & Gere Engineers, Inc.
To : Renato Nojadera - WSSC
CC : Gary Fontaine, William Meinert, George Oma, Kanu Shah

Renato, this submittal has been reviewed; recommended status is "APPROVED AS NOTED - RESUBMIT". Please refer to the attached comment sheet. Please let me know if there are any questions. Thank you.

Files Attached (1) : 46981_SD Comments_11342-01.pdf

Renato Nojadera from *WSSC* held this form for 0.00 days as of 3/18/2011 8:16:37 AM Eastern Time

By : Renato Nojadera - WSSC
To : Laura Knox - O'Brien & Gere Engineers, Inc.
CC : Mechanical Submittal Review

Laura,
Please review this submittal and return your comments no later than 4/7/2011. Thank you.

Rosita Cowan from *Norair Engineering Corp.* filled out this form at 3/17/2011 5:38:38 PM Eastern Time

To : Renato Nojadera - WSSC
CC: Henry Cassi, Simon Jimenez, Mechanical Submittal Review, George Oma, Kanu Shah, Gary Fontaine, William Meinert, Mechanical Submittal Review, Laura Knox

FYI - This form is CLOSED
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support@e-Builder.net

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ii. Scope of Supply
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  - 3. Dimensional Drawing
  - 4. Performance Curves
- B. Motor Data
  - 1. Motor Information
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  - 1. Product Brochure
- E. Spare Parts Furnished
- F. Push Button Station
  - 1. Data Sheets
  - 2. Push Button Station Drawing

AUTHORIZED SERVICE FACILITY

The local authorized facility for field service, repair, and spare parts is:

Geiger Pump and Equipment Co.
8924 Yellow Brick Road
Baltimore MD 21237

Phone: 410 682-2660
Fax: 410 682-4750
Email: info@geigerinc.com

SCOPE OF SUPPLY

Section 11342: Carbon Recirculation Pumps

Qty two (2) Viking Pumps (IDEX), model QS4127A gear pumps, in stainless steel construction as specified, with 10Hp explosion proof premium efficiency c-face motors, 3ph 460V 60Hz, single cartridge mechanical seals as specified, in-line-gear reducers, coupling guard and fabricated baseplate

Equipment Tag Numbers:

CRP-1	Carbon Recirculation Pump No. 1
CRP-2	Carbon Recirculation Pump No. 2

I Section 11342: Carbon Recirculation Pumps

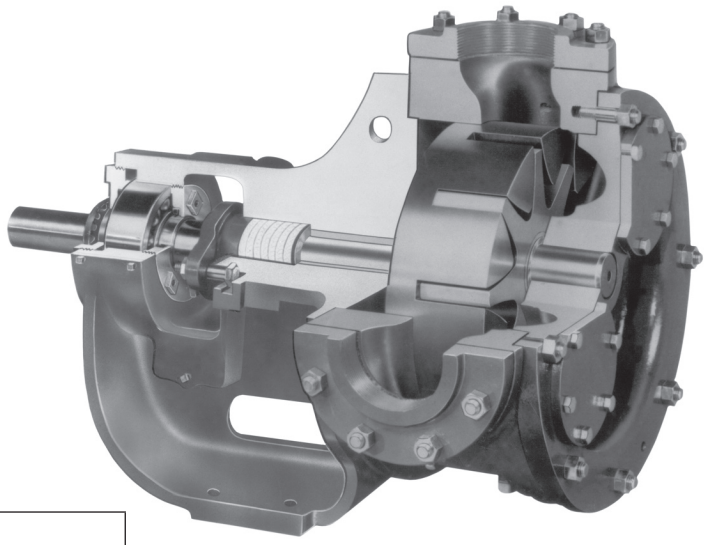
A. Pump Data Viking Model Q4127A

VIKING® HEAVY DUTY PUMPS

~~SERIES 127 AND~~ 4127
STAINLESS STEEL CONSTRUCTION

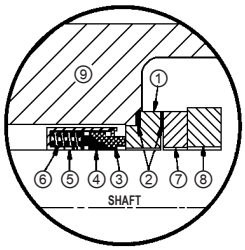
Section	161
Page	161.1
Issue	C

FEATURES



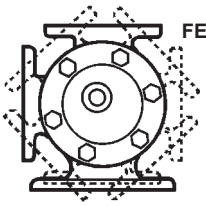
SERIES 127 Pumps
Cutaway View—(Packed Type)
160-200-280 GPM Sizes
(36-45-64 m³/hr)
Shown without over-pressure relief valve

MECHANICAL SEAL (SERIES 4127)
"LS", "Q" and "M" SIZES



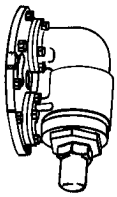
① Stellite Stationary Seat
② Seat Gaskets PTFE
③ Carbon Rotating Face (Washer)
④ PTFE
⑤ 316 Stainless Steel Metal Parts
⑥ 316 Stainless Steel Springs
⑦ 316 Stainless Steel Seal Holder
⑧ 316 Stainless Steel Seal Plate
⑨ Pump Bracket

FEATURES



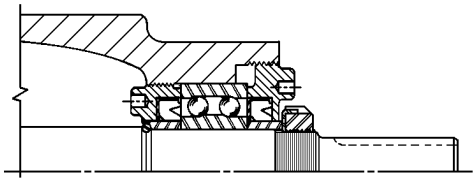
REVOLVABLE PUMP CASING (Standard Equipment)

All Series 127 and 4127 pumps are equipped with pump casings that can be turned to eight positions. This allows ports to easily match piping. Relief valve must point to suction port in all cases.



OVER-PRESSURE RELIEF VALVE (Standard Equipment)

Valve permits bypassing of liquids and prevents excessive pressures in the discharge line. If reversing pump, remove valve and turn end for end. Relief valve must point to suction port in all cases. All valves set at 50 lbs. unless otherwise requested. If Viking over-pressure relief valve is not used, pumping system should include some form of over-pressure protection, e.g., valve in discharge line, torque limiting devices, rupture discs, etc.



POSITIVE-LOCK THRUST CONTROL

Series 127 and 4127 pumps are manufactured with positive-lock thrust control for accurate axial positioning of rotor and shaft. Illustration shows bearing and double end cap arrangement.

① Pressure Range	50 PSI (3 BAR) for 38 to 100 SSU (4 to 21 cSt)
	100 PSI (7 BAR) for 100 to 2,500 SSU (21 to 540 cSt)
	125 PSI (9 BAR) for 2,500 SSU (540 cSt) and above
① Temperature Range	-20°F. to +500°F. (-29°C. to +260°C.)
① Viscosity Range	28 SSU to 2,000,000 SSU (0.1 cP to 440,000 cSt)

GPM 160-200-280
(m³/hr 36-45-64)

② (Nominal Rating)

For tough pumping applications that require 316 Stainless Steel, these proven heavy-duty pumps can do the job. Their rugged construction provides long life and peak, trouble-free operation for the chemical, petrochemical, food and other process industries, as well as in general industry. They are an excellent choice for handling fructose and other syrups.

They are furnished as standard with packed type (Series 127) or mechanical seal (Series 4127) construction, to minimize liquid loss and for shaft protection. The positive-lock thrust control provides micrometer adjustments for accurate rotor and shaft positioning to help you keep operating with new-pump efficiency through years of heavy-duty service.

The smooth positive displacement action of our "gear-within-a-gear" rotor and idler combination delivers a cushioned positive flow and low-shear transmission of your liquid year after year without foaming or churning.

Series 4127 mechanical seal pumps can handle a wide variety of liquids with viscosities up to 25,000 SSU. Special seals are available for higher viscosities. Consult the factory for details.

① Values shown represent minimums or maximums. Some special construction or consideration may be required before a cataloged pump can be applied to an application involving maximum pressure or minimum or maximum temperature and/or viscosity. Certain models have restrictions in pressures and/or viscosities. See specifications, page 161.4, and performance curves.

② Nominal capacities based on handling thin liquids at low pressures.

Metric conversions are based on US measurements and rounded to the nearest whole number.

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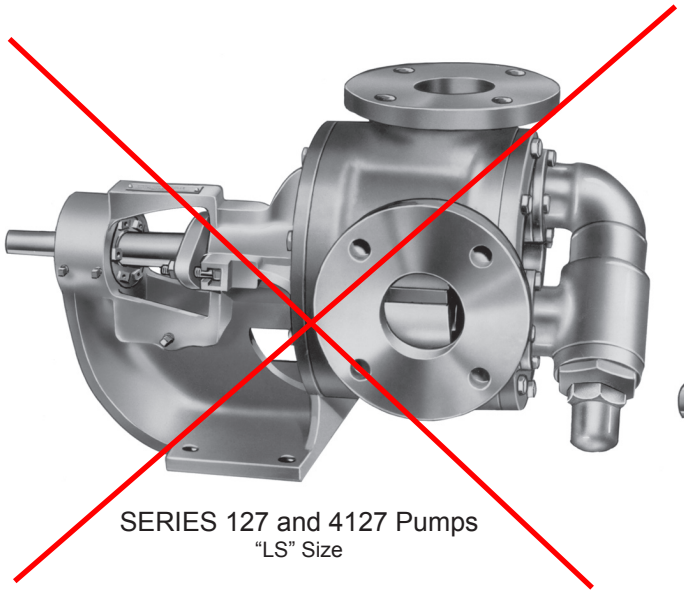
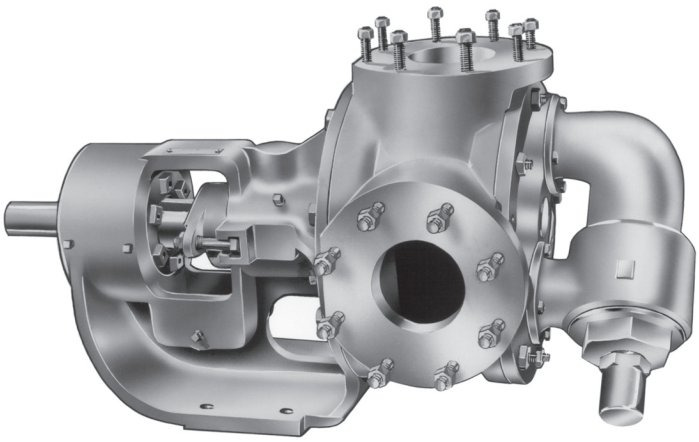
VIKING® HEAVY DUTY PUMPS
SERIES 127 AND 4127
STAINLESS STEEL CONSTRUCTION

UNMOUNTED PUMPS



SERIES 127 and 4127 Pumps
"LS" Size



SERIES ~~127 and~~ 4127 Pumps
"Q" ~~and "M"~~ Sizes

This series of heavy-duty pumps is available either unmounted or mounted units as shown on following pages. In the Series 4127 the standard seal is a PTFE type with carbon rotating and corrosion resistant stationary faces. High quality type 316 Stainless Steel is provided on wetted parts which come in contact with the pumped product. The integral thrust bearing is designed to handle heavy-duty pumping jobs without problems of end play and distortion. For increased versatility of installation and complete selection of ports, the pump casing is designed so it can be rotated on the bracket to any 45° or 90° angle from that shown in the illustrations. See revolvable casing feature on Page 161.1. Overpressure relief valve on head is standard for this series. To permit use of this type pump in a greater range of application, these pumps are available with jacketed heads. For heavy-duty pumps, stainless steel with jacketed bracket and head, see Catalog Section 162.

Dimensions for Unmounted Pumps—See Page 161.8.

Performance Data for Unmounted Pumps—See Pages 161.13 through 161.22.

CONSTRUCTION — SERIES 127 AND ① 4127 ("LS", "Q" AND "M" SIZES)

Pump Construction	Casing	Head	Bracket	Rotor	Idler	Rotor Shaft	Idler Pin	Shaft Sealing		Internal Relief Valve
								Packed	Mechanical Seal	
316 Stainless	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Coated Stainless Steel	Standard	Stainless Steel - PTFE with Carbon Graphite and Corrosion-Resistant Material	Stainless Steel

SPECIFICATIONS — SERIES 127 AND ① 4127 UNMOUNTED PUMPS

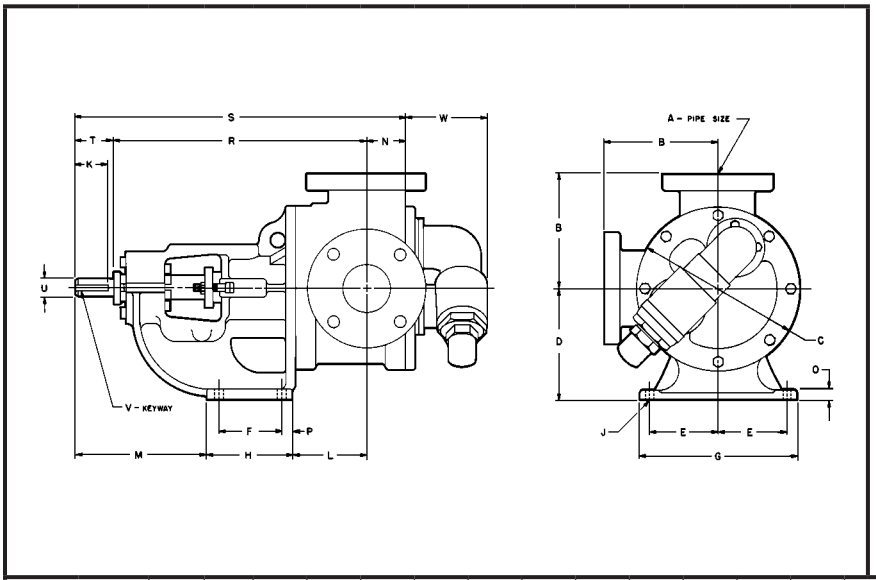
Model Number		150 lb. ANSI Flange Port Size	⑤ Nominal Pump Rating		Motor HP Required At Rated Speed Pumping 100 SSU Liquid		Maximum Hydrostatic Pressure	⑥ Maximum Recommended Discharge Pressure Handling 100 SSU Liquid At Rated Speeds	③ Maximum Recommended Temperature for Cataloged Pump °F. (°C.)		Approximate Shipping Weight With Valve
Packed	① Mech. Seal	② Inches	GPM (m^3/hr)	RPM	50 PSI (3 BAR)	100 PSI (7 BAR)	PSIG (BAR)	PSIG	Packed	④ Mech. Seal	Pounds (KG)
LS127	LS4127	3	160 (36)	520	7½	15	400 (28)	100	225 (107)	225 (107)	190 (86)
Q127	Q4127	4	200 (45)	350	10	20	400 (28)	100	275 (125)	275 (125)	440 (200)
M127	M4127	4	280 (64)	280	15	25	400 (28)	100	275 (125)	275 (125)	600 (272)

① For mechanical seal pumps on applications with viscosities above 25,000 SSU (5,500 cSt), provide details for recommendation.
② Ports are suitable for use with 150# ANSI stainless steel companion flanges or flanged fittings.
③ Special adjustment or construction may be required for higher temperatures.
④ Standard seal can be used from -20°F. to +450°F. With special construction, higher temperatures can be handled with this series pumps.
⑤ Nominal rating based on handling thin liquids.
⑥ For maximum recommended discharge pressures when handling other viscosities and/or other speeds, see performance curves. Performance curves also show preferred constructions. If suction pressure exceeds 50 PSIG (3 BAR), consult factory.

Metric conversions are based on US measurements and rounded to the nearest whole number.

VIKING® HEAVY DUTY PUMPS
SERIES 127 AND 4127
STAINLESS STEEL CONSTRUCTION

DIMENSIONS
These dimensions are average and not for construction purposes. Certified prints on request.

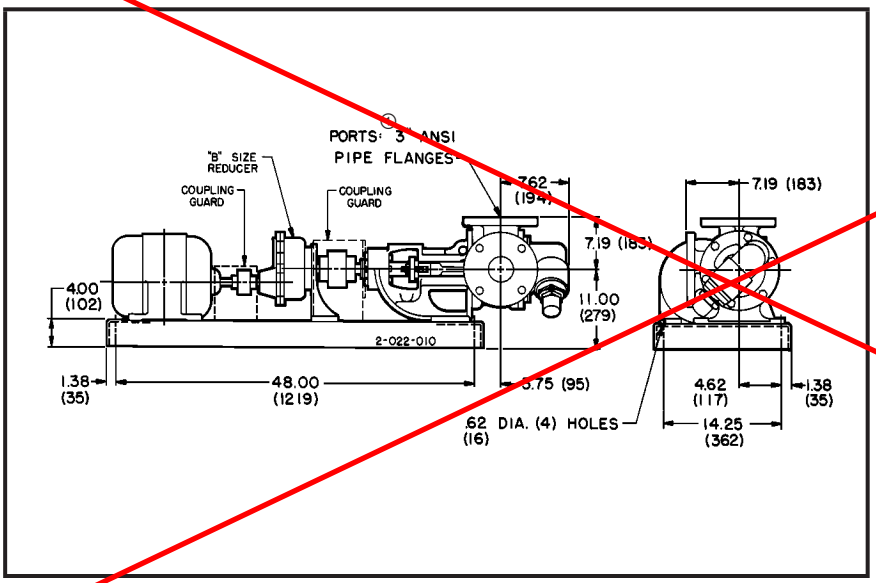


For specifications, see page 161.2.

DIMENSIONS— SERIES 127 AND 4127 UNMOUNTED PUMPS

① Ports are suitable for use with 150# ANSI stainless steel companion flanges or flanged fittings.

MODEL NO.		①																				
PACKED	SEAL	A		B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	U	V	W
LS127	LS4127	3	in	7.19	10.25	7.00	4.38	4.00	10.00	5.38	.53	3.25	4.75	9.12	2.44	.62	.62	15.75	21.69	3.50	1.438	.38 x .19	5.19
			mm	183	260	178	111	102	254	137	13	83	121	232	62	16	16	400	551	89	36.51	9.53 x 4.76	132
Q127	Q4127	4	in	8.25	14.00	8.75	4.12	4.00	10.00	6.00	.69	4.38	6.62	11.12	3.00	.75	1.00	19.25	26.75	4.50	1.938	.50 x .25	8.19
			mm	210	356	222	105	102	254	152	18	111	168	282	76	19	25	489	679	114	49.21	12.70 x 6.35	208
M127	M4127	4	in	9.50	17.25	10.00	5.00	6.00	12.00	8.50	.69	4.00	7.75	8.12	4.00	1.00	1.50	20.12	28.38	4.25	1.938	.50 x .25	8.50
			mm	241	438	254	127	152	305	216	18	102	197	206	102	25	38	511	721	108	49.21	12.70 x 6.35	216



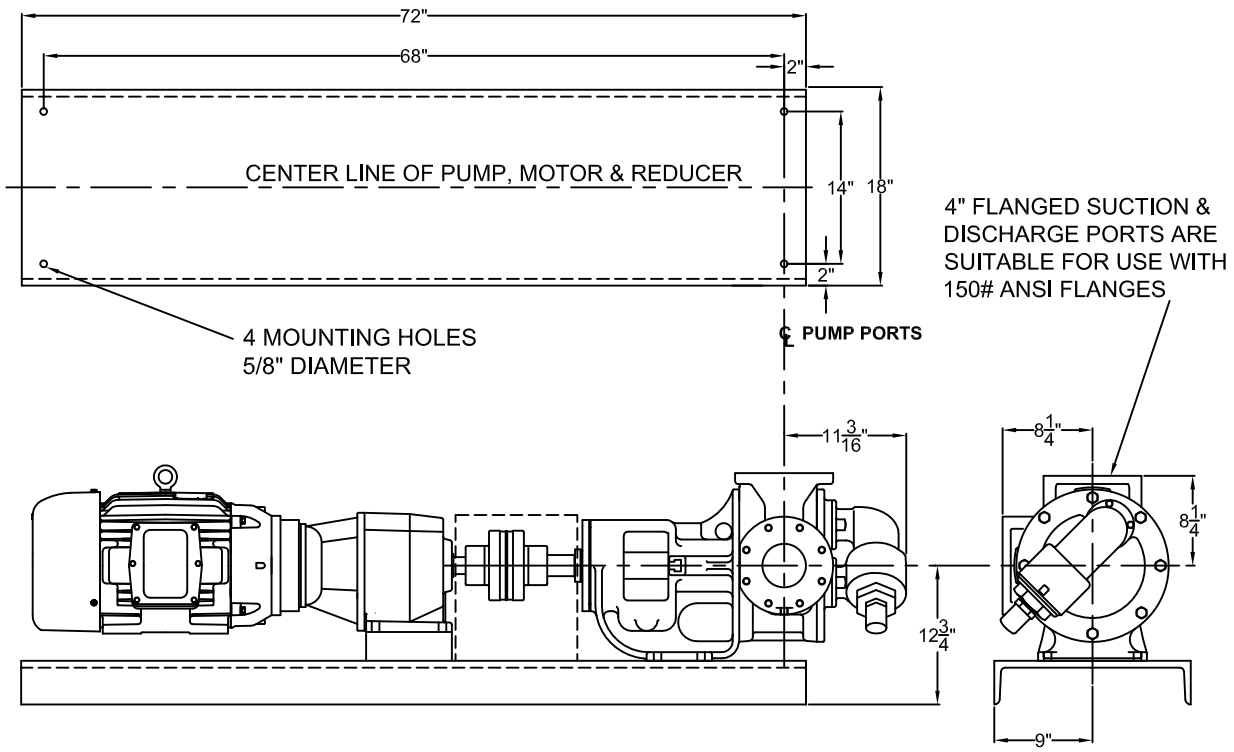
For specifications, see pages 161.3. and 161.4.

DIMENSIONS — SERIES 127 AND 4127 ("R" DRIVE) "LS" SIZE PUMP "B" SIZE REDUCER UNITS

① Ports are suitable for use with 150# ANSI stainless steel companion flanges or flanged fittings.

NOTE: Units available to accept 10 HP, 1200 RPM maximum motor.

NOTE: Motor rails 2" high are required on "LS" size units with 184-T or 4½" center height motors.



PUMP SPECIFICATIONS

Viking Model:	Q4127A	**Rotor:**	316 SS
Casing:	316 SS	**Shaft:**	316 SS
Idler:	770 SS	**Brkt Bushing:**	CG
Idler Bushing:	CG	**Rotation:**	RH
Relief Valve Set @ 35 PSIG			

Mechanical Seal

Manufacturer:	Flowserve	**Elastomers:**	Viton
Type:	84	**P/N:**	2-480-304-999

MOTOR

Manufacturer:	Baldor/Reliance	**RPM:**	1800
Model:	CM7054T	**Frame:**	254TC
HP:	15	**Enclosure:**	Exp Proof
Volts/Ph/Hz:	230-460/3/60	**SF:**	1.15

GEAR REDUCER

Manufacturer:	Viking	**Size:**	51
Model:	3-551-51C-056-25	**Gear Ratio:**	5.63:1

COUPLING

Manufacturer:	TB Woods	**Pump Bore:**	1 15/16"
Model:	9SC35 W/ Hytrel Sleeve	**Gear Bore:**	1.9/16"

PROCESS SPECIFICATIONS

Fluid:	Carbon Chemical Solutions	**SG:**	0.80 to 1.22
Flow (GPM):	150	**Visc (CPs):**	1.2 to 450
TDH (PSI):	20 PSIG		

COUPLING GUARDS: NON-SPARKING ALUMINUM

MODIFIED STRUCTURAL STEEL BASE: 18" x 42.7# / FT CHANNEL STEEL

IMPORTANT:

1. VIKING PUMPS OPERATE EQUALLY WELL IN EITHER DIRECTION OF ROTATION. RELIEF VALVE BONNET ALWAYS POINTS TOWARDS SUCTION. STANDARD ARRANGEMENT IS RIGHT HAND SUCTION, HYDRAULIC INSTITUTE - CLOCKWISE ROTATION AS SHOWN ABOVE.
2. PUMPS NOT FURNISHED WITH A RELIEF VALVE MUST BE FURNISHED WITH SOME MEANS OF PRESSURE PROTECTION (IN-LINE PRESSURE RELIEF VALVE, TORQUE LIMITING DEVICE, ETC.). FOR ADDITIONAL INFORMATION ON PRESSURE RELIEF VALVES, REFER TO VIKING PUMP TECHNICAL SERVICE MANUAL TSM000 AND BULLETIN ESB-31.

GENERAL NOTES:

1. CONSULT TECHNICAL SERVICE MANUAL BEFORE INSTALLING UNIT.
2. ALL DIMENSIONS GIVEN IN INCHES UNLESS OTHERWISE SHOWN.
3. ALL PIPE TAPS ARE STANDARD NPT THREADS.
4. ALL HOLES IN FLANGES STRADDLE CENTERLINES.
5. ALL FLANGES CONFORM TO ANSI STD DRILLING UNLESS OTHERWISE SHOWN.
6. FOUNDATION BOLTS AND PIPING SHOULD NOT BE SET RIGIDLY UNTIL RECEIPT OF EQUIPMENT.
7. ALL PIPING TO AND FROM PUMP MUST BE INDEPENDENTLY SUPPORTED AND RIGIDLY ANCHORED.
8. BOLTS AND STUDS FOR MATING FLANGES NOT FURNISHED. USE FLAT WASHERS BEHIND FLANGES.
9. WHEN LIFTING UNIT DO NOT LIFT ON SHAFT EXTENSION OR SUCTION AND DISCHARGE FLANGES.
10. THE DESIGN OF PIPING SYTEM, FOUNDATIONS, AND OTHER AREAS OF SYSTEM DESIGN ARE RESPONSIBILITY OF OTHERS. SMITH-KOCH DATA AND COMMENTS ARE OFFERED AS AN AID, BUT SMITH-KOCH CANNOT ASSUME THE RESPONSIBILITY FOR THE DESIGN AND OPERATION.

Geiger Pump and Equipment, Co.

8924 Yellow Brick Road, Baltimore, MD 21237

TITLE **Q4127A**

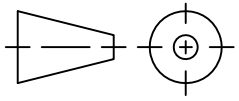
Customer: Piscataway ENR

Purchase Order: 321-101

Tag Number:

Service:

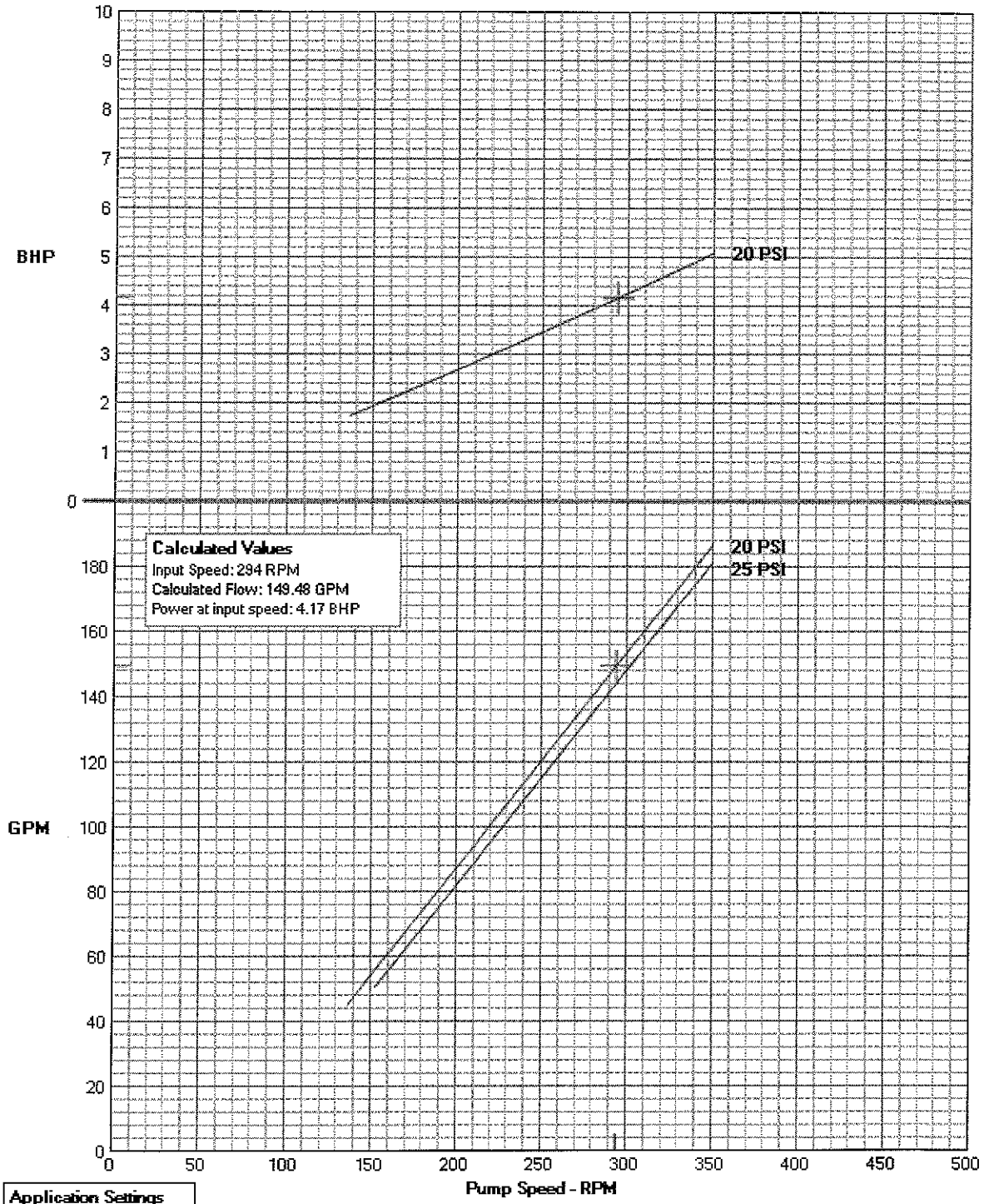
THIRD ANGLE PROJECTION



Drawn PTF			Date 12-09-10
Certified			Date
SHOP TICKET X1348CB1	**DRAWING NO. 10K0981B**	SCALE: NONE	REV A

Differential Pressure Performance Curve

100% Methanol



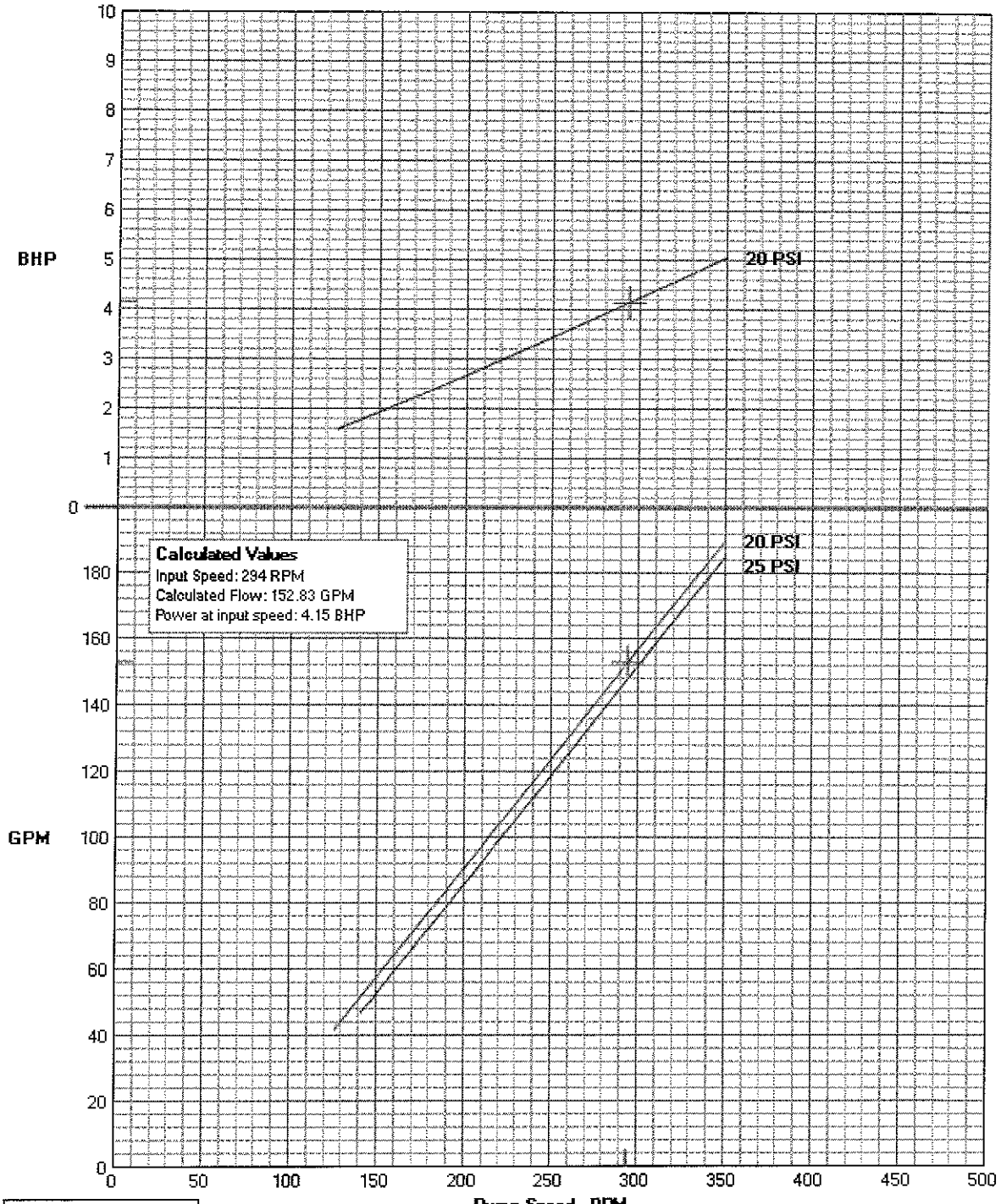
Application Settings
Model: Q127A
Viscosity: 0.5 cP
Diff. Pressure: 20 PSI
Temperature: 20 C
Specific Gravity: 0.79

Warnings
Specified viscosity has been increased to the minimum-rated viscosity of 0.5 cP

Viking Pump, A Unit of IDEX Corporation, 406 State Street, Cedar Falls, Iowa, USA, 50613,

Differential Pressure Performance Curve

100% Ethanol

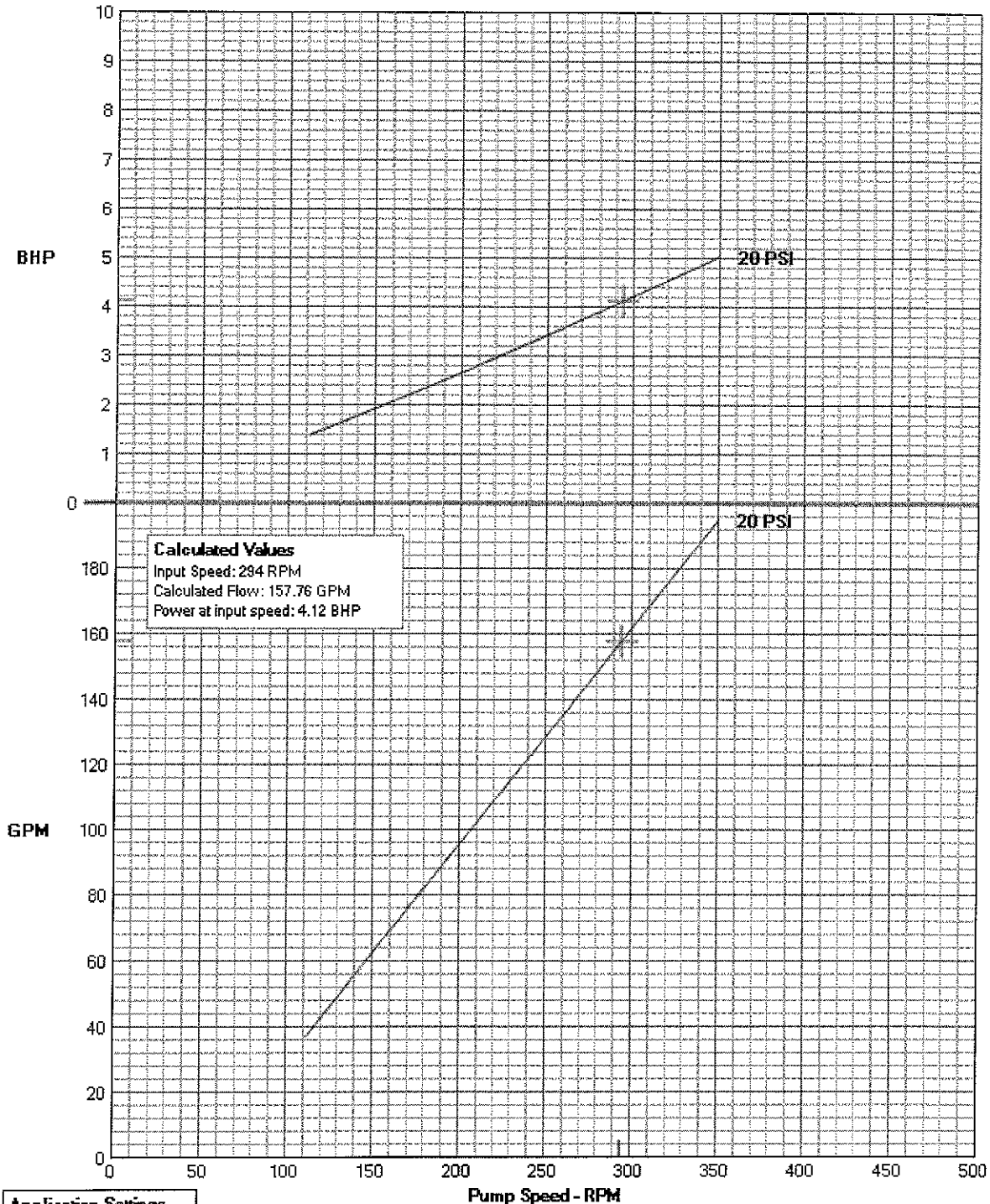


Application Settings
Model: Q127A
Viscosity: 0.7 cP
Diff. Pressure: 20 PSI
Temperature: 20 C
Specific Gravity: 0.81

Viking Pump, A Unit of IDEX Corporation, 406 State Street, Cedar Falls, Iowa, USA, 50613,

Differential Pressure Performance Curve

100% Propanol

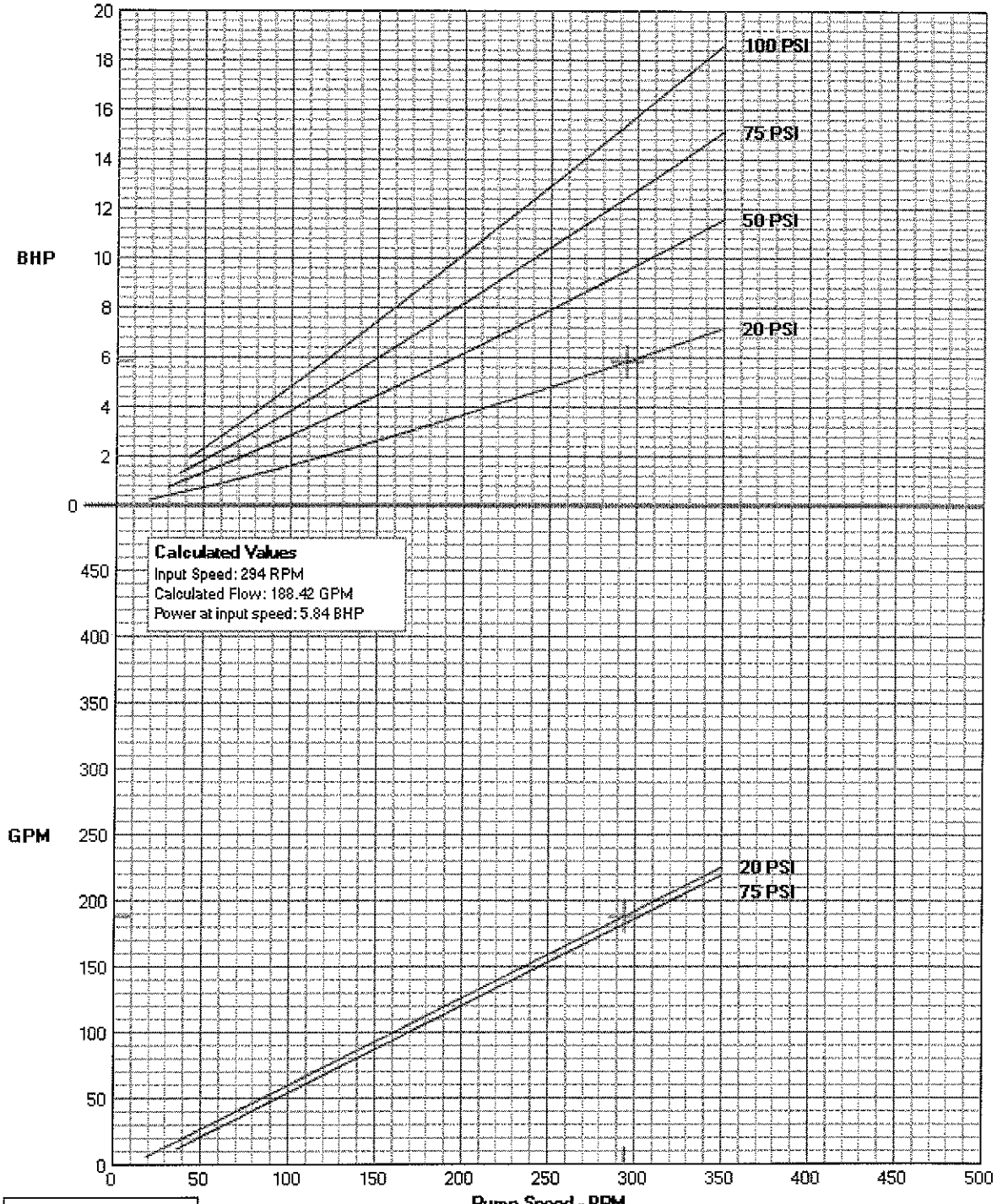


Application Settings
Model: Q127A
Viscosity: 2.1 cP
Diff. Pressure: 20 PSI
Temperature: 25 C
Specific Gravity: 0.79

Viking Pump, A Unit of IDEX Corporation, 406 State Street, Cedar Falls, Iowa, USA, 50613,

Differential Pressure Performance Curve

Waste Glycerin

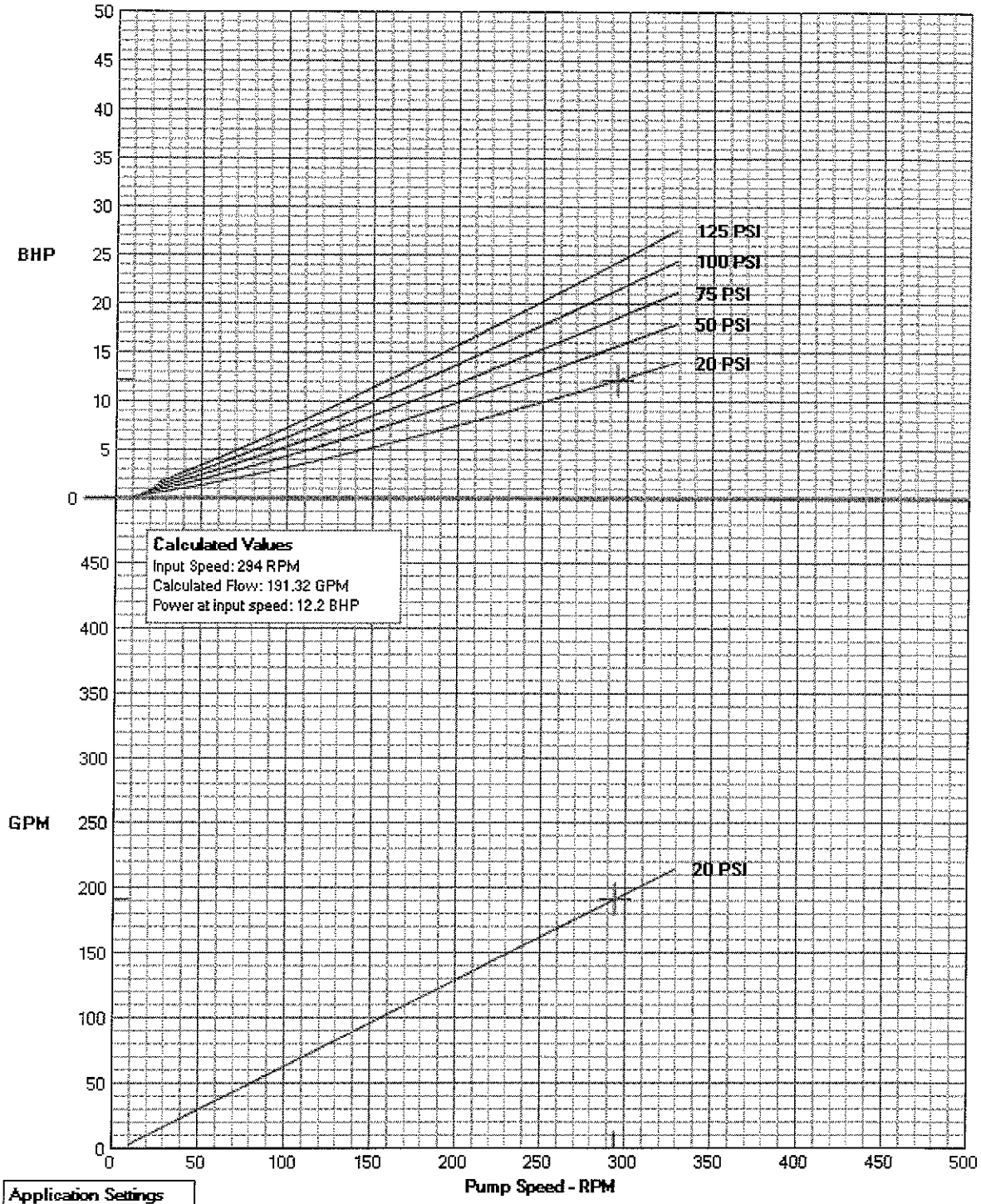


Application Settings
Model: Q127A
Viscosity: 448.7 cP
Diff. Pressure: 20 PSI
Temperature: 22 C
Specific Gravity: 1.26

Viking Pump, A Unit of IDEX Corporation, 406 State Street, Cedar Falls, Iowa, USA, 50613,

Differential Pressure Performance Curve

Waste Glycerin

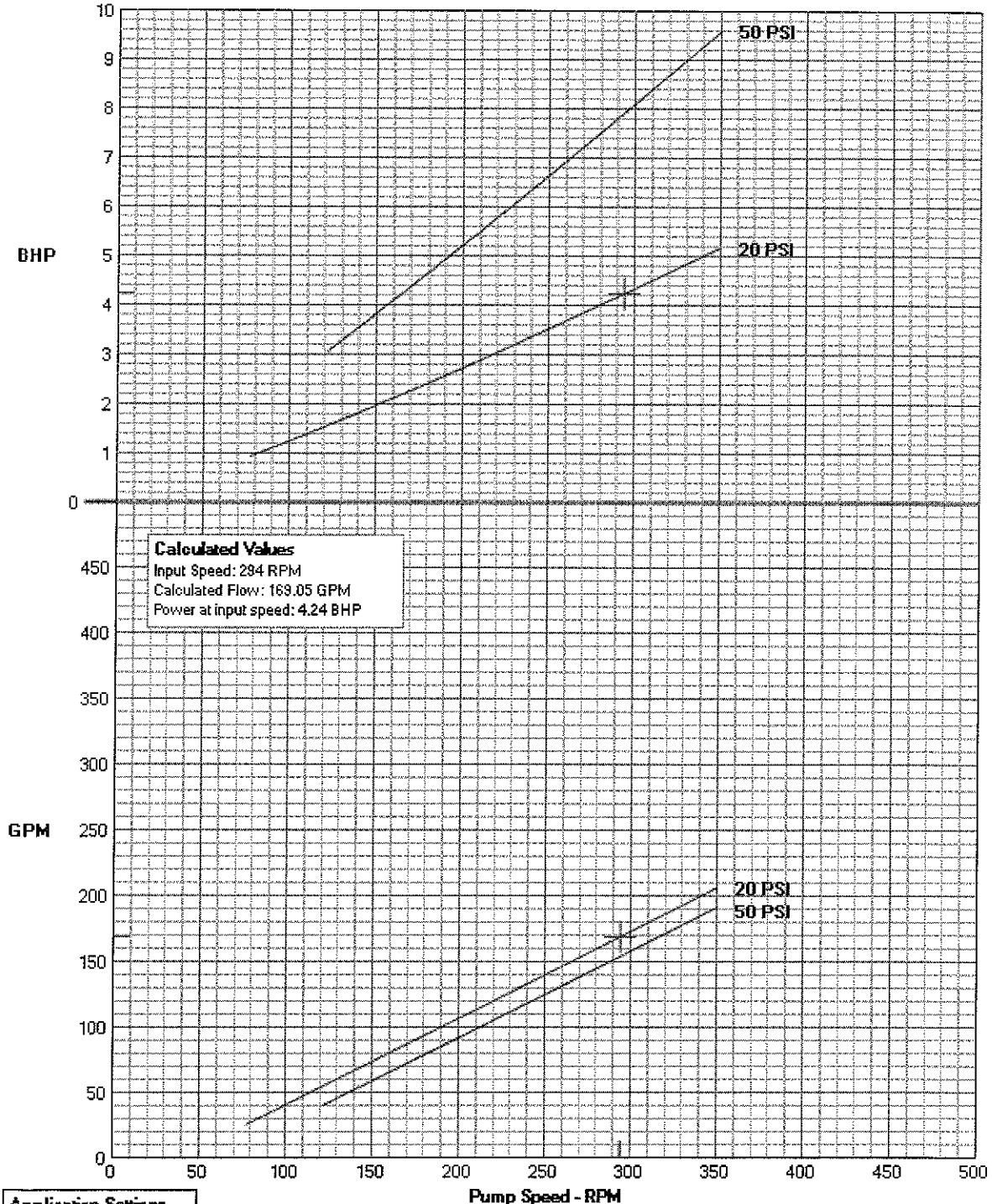


Application Settings
Model: Q127A
Viscosity: 3485.5 cP
Diff. Pressure: 20 PSI
Temperature: 0 C
Specific Gravity: 1.26

Viking Pump, A Unit of IDEX Corporation, 406 State Street, Cedar Falls, Iowa, USA, 50613,

Differential Pressure Performance Curve

50% Sugar Water

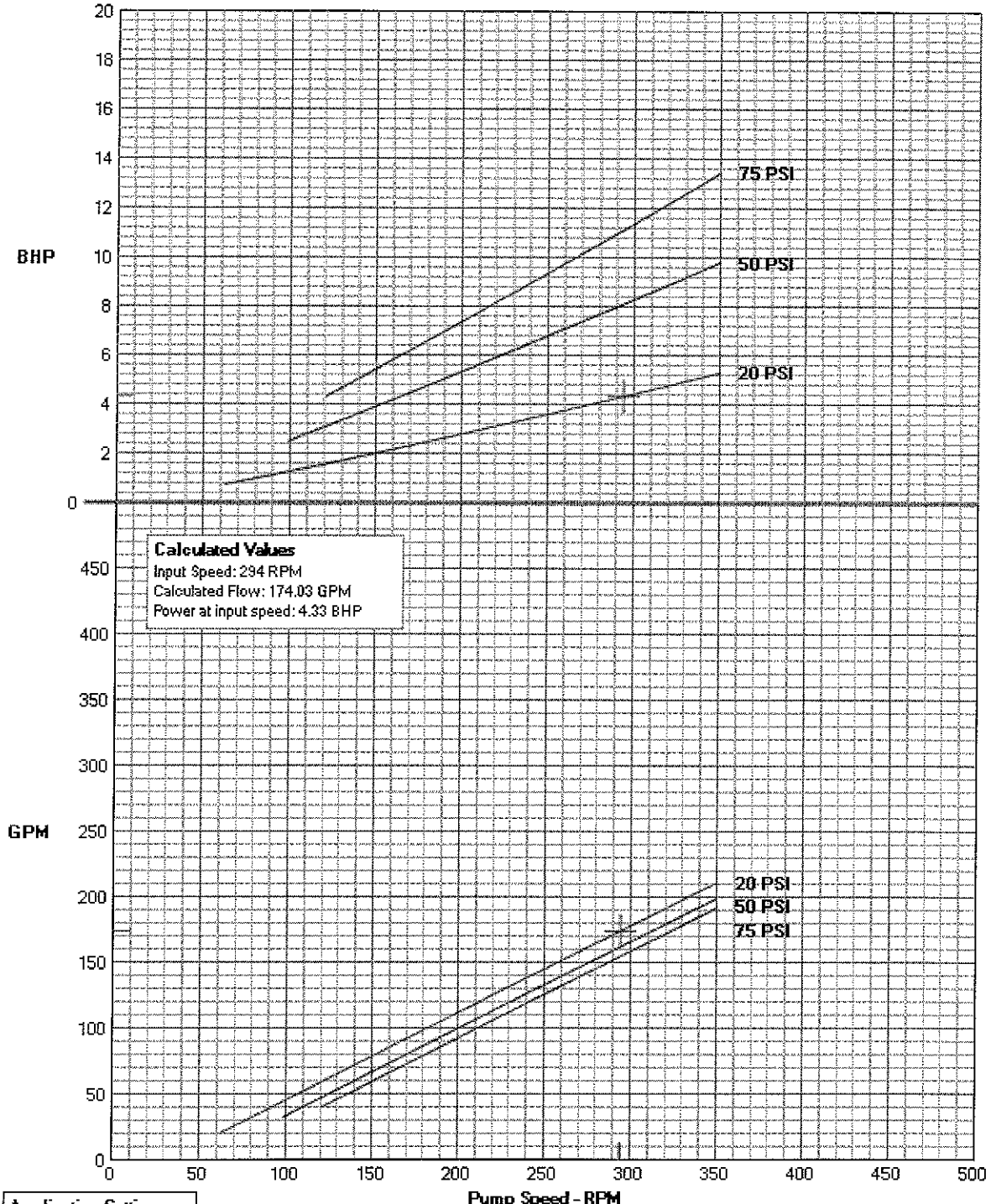


Application Settings
Model: Q127A
Viscosity: 14.8 cP
Diff. Pressure: 20 PSI
Temperature: 24 C
Specific Gravity: 1.25

Viking Pump, A Unit of IDEX Corporation, 406 State Street, Cedar Falls, Iowa, USA, 50613,

Differential Pressure Performance Curve

MicroC G



Application Settings
Model: Q127A
Viscosity: 19.9 cP
Diff. Pressure: 20 PSI
Temperature: 25 C
Specific Gravity: 1.19

Viking Pump, A Unit of IDEX Corporation, 406 State Street, Cedar Falls, Iowa, USA, 50613,

I Section 11342: Carbon Recirculation Pumps
B. Motor Data

BALDOR
A MEMBER OF THE ABB GROUP

BALDOR • RELIANCE

Product Information Packet

CEM7054T

15//10HP,1765//1470RPM,3PH,60/50HZ,254TC

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Part Detail							
Revision:	B	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	0942M	**Elec. Spec:**	09WGW980	**CD Diagram:**	
Enclosure:	XPFC	**Mfg Plant:**		**Mech. Spec:**	09E689	**Layout:**	
Frame:	254TC	**Mounting:**	F1	**Poles:**	04	**Created Date:**	06-14-2010
Base:	RG	**Rotation:**	R	**Insulation:**	B	**Eff. Date:**	06-24-2011
Leads:	9#12	**Literature:**		**Elec. Diagram:**		**Replaced By:**	

Nameplate NP1426XP					
NO.		**CC**	010A		
SER.					
SPEC.	09E689W980G5				
CAT.NO.	CEM7054T				
HP	15//10	**T. CODE**	T3C		
VOLTS	230/460//190/380				
AMPS	36/18//28.8/14.4				
RPM	1765//1470				
HZ	60//50	**PH**	3	**CL**	B
SER.F.	1.00	**DES**	B	**CODE**	H
RATING	40C AMB-CONT				
FRAME	254TC	**NEMA-NOM-EFF**	92.4	**PF**	84
USABLE AT 208V	37				

Parts List

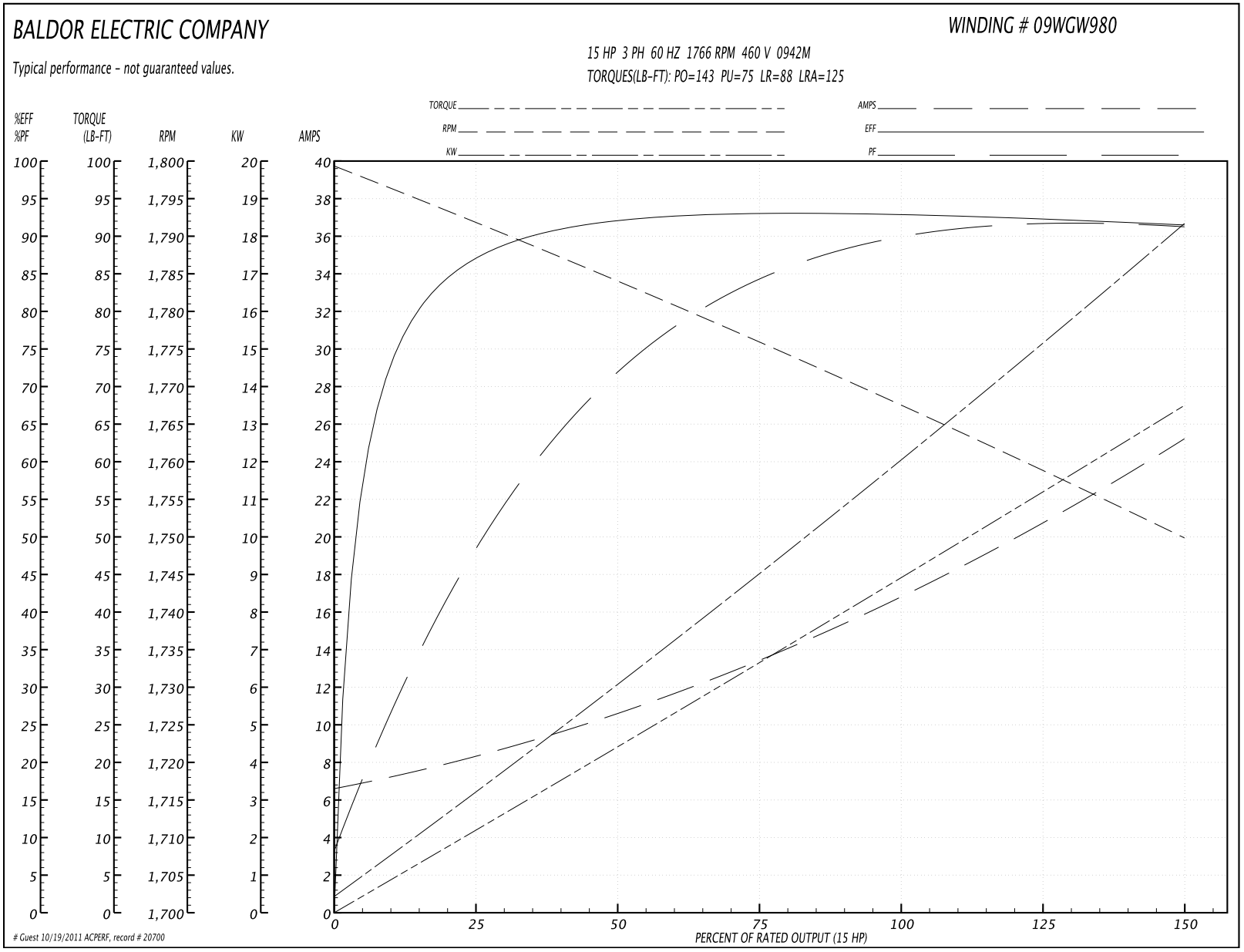
Part Number	Description	Quantity
SA198394	SA 09E689W980G5	1.000 EA
RA185762	RA 09E689W980G5	1.000 EA
MJ5000A01	SEALANT, CHICO A COMPOUND	0.050 LB
09CB1000A01SP	CONDUIT BOX, MACH	1.000 EA
10XN3118K16	5/16-18 X 1" GRADE #5, STL, ZINC PLATE	4.000 EA
HW1001A31	LOCKWASHER 5/16, ZINC PLT.591 OD, .319 I	4.000 EA
WD1000B16	KPA-4C BURNDY TERMINAL	1.000 EA
10XN2520K06	1/4-20 X 3/8" HX HD SCREWGRADE 5, ZINC P	1.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	1.000 EA
09EP1700A01	FR ENDPLATE, MACH	1.000 EA
10XN3816K28	3/8-16 X 1.75 HEX HD CAP SCREW, GRADE 5	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
HW5100A08	W3118-035 WVY WSHR (WB)	1.000 EA
10XN2520K36	1/4-20 X 2.25" HX HD SCRWGRADE 5, ZINC P	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
09EP1708A02	FACE MTD. ENDPLATE, MACH X-PROOF (NEW DE	1.000 EA
10XN3816K28	3/8-16 X 1.75 HEX HD CAP SCREW, GRADE 5	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
09FH1004A01	FAN COVER, MACH	1.000 EA
10XN2520K14	1/4-20 X .88 HEX GRD 5 (20001)	3.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	3.000 EA
09CB1500A01SP	CONDUIT BOX LID, MACH	1.000 EA
10XN2520K16	1/4-20 X 1" HX HD SCRW GRADE 5, ZINC P	6.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	6.000 EA

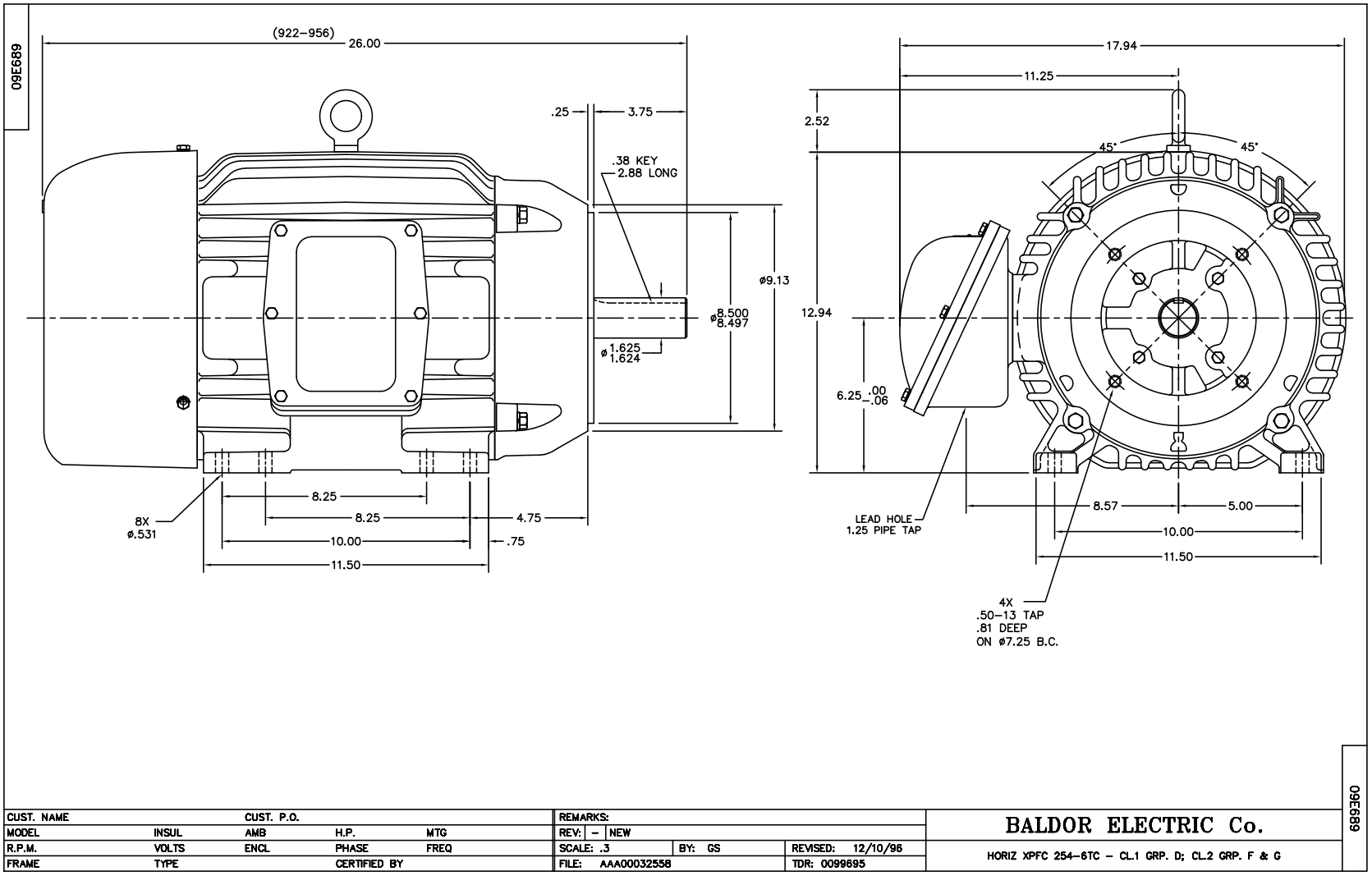
Parts List (continued)

Part Number	Description	Quantity
HW2501G25	KEY, 3/8 SQ X 2.875	1.000 EA
LB1115	LABEL,LIFTING DEVICE	1.000 EA
LB1073	LABEL, UL/CSA "XP"	1.000 EA
LB5040	INSTRUCTION TAG, AC & DC	1.000 EA
HW4500A20	1/8NPT SL PIPE PLUG	2.000 EA
MJ1000A75	GREASE, POLYREX EM EXXON	0.080 LB
HW4500A20	1/8NPT SL PIPE PLUG	2.000 EA
09FN3001D01	EXTERNAL FAN, PLASTIC	1.000 EA
HW2500A25	WOODRUFF KEY USA #1008 #BLOW CARBON STEE	1.000 EA
51XB1214A20	12-14X1.25 HXWSSLD SERTYB	1.000 EA
MG1025G05	PAINT 789.201 (WILCO) DARK GRAY METALLIC	0.050 GA
85XU0407A04	#4-7 X 1/4 DRIVE PIN	6.000 EA
LB1119	WARNING LABEL	1.000 EA
LB1125C02	SUPER-E (STOCK CTN LABEL SUPER-E WITH FL	4.000 EA
LB1357	ENERGY GUIDE LABEL (BOX LABEL)	1.000 SH
LC0145B01	CONNECTION LABEL	1.000 EA
NP1426XP	UL/CSA, CLI GP-D,CLII GP-F&G,CC	1.000 EA
40PA1005	PACKAGING GROUP, 09 STD	1.000 EA

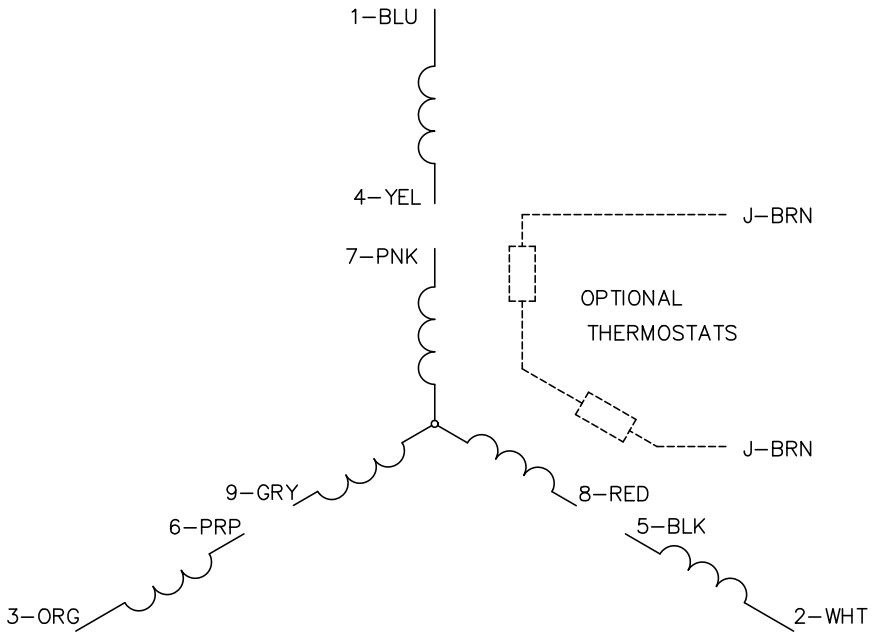
Performance Data at 460V, 60Hz, 15.0HP (Typical performance - Not guaranteed values)							
General Characteristics							
Full Load Torque:	45.0 LB-FT			**Start Configuration:**		DOL	
No-Load Current:	6.95 Amps			**Break-Down Torque:**		143.0 LB-FT	
Line-line Res. @ 25°C.:	0.577 Ohms A Ph / 0.0 Ohms B Ph			**Pull-Up Torque:**		75.0 LB-FT	
Temp. Rise @ Rated Load:	47 C			**Locked-Rotor Torque:**		88.0 LB-FT	
Temp. Rise @ S.F. Load:				**Starting Current:**		125.0 Amps	
Load Characteristics							
% of Rated Load	**25**	**50**	**75**	**100**	**125**	**150**	**S.F.**
Power Factor:	49.0	71.0	81.0	86.0	88.0	89.0	87.0
Efficiency:	87.9	92.1	93.0	92.8	92.3	91.5	92.5
Speed:	1792.0	1784.0	1776.0	1766.0	1759.0	1750.0	1762.0
Line Amperes:	7.9	10.5	13.7	17.2	21.0	25.0	19.5

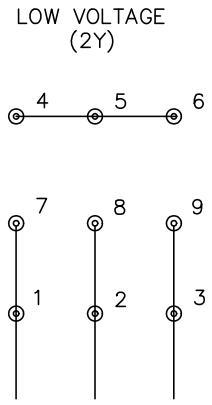
Performance Graph at 460V, 60Hz, 15.0HP Typical performance - Not guaranteed values

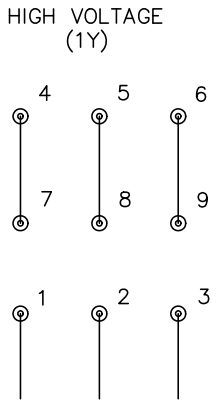



09E689
(922–956)
26.00
.25
3.75
.38 KEY
2.88 LONG
ø9.13
ø8.500
8.497
ø1.625
1.624
8X
ø.531
8.25
8.25
4.75
10.00
.75
11.50
17.94
11.25
2.52
45°
45°
12.94
6.25 .00 –.06
LEAD HOLE
1.25 PIPE TAP
8.57
5.00
10.00
11.50
4X
.50–13 TAP
.81 DEEP
ON ø7.25 B.C.
09E689
CUST. NAME
CUST. P.O.
MODEL
INSUL
AMB
H.P.
MTG
R.P.M.
VOLTS
ENCL
PHASE
FREQ
FRAME
TYPE
CERTIFIED BY
REMARKS:
REV: – NEW
SCALE: .3
BY: GS
REVISED: 12/10/96
FILE: AAA00032558
TDR: 0099695
BALDOR ELECTRIC Co.
HORIZ XPFC 254–6TC – CL.1 GRP. D; CL.2 GRP. F & G

CD0005







NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	3PH, DV, 9 LEADS

I Section 11342: Carbon Recirculation Pumps
C. In-Line Reducer

Viking In-Line Helical Gear Reducers

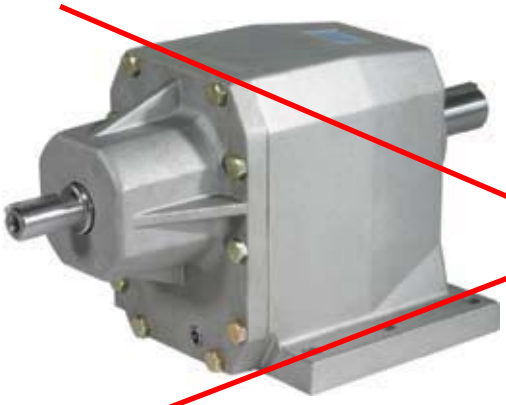
Section	615
Page	615.1
Issue	C

Gear Ratio Range: (varies by reducer size)	From 2.63:1 to 38.0:1 (Varies by reducer size)
Output Speeds (with 1750 rpm input)	46 – 665 rpm
Reducer Horsepower Range:	.5 HP (.37 kW) to 350 HP (261 kW)

Major Design Features

Features:

- Available in eleven different sizes and a variety of ratios, all double reduction
- Compact design
- Universal mounting
  - solid input shaft
  - hollow input shaft with NEMA C or IEC Flange Mount Option
- High efficiency
- Low noise levels
- Gears in hardened and case-hardened steel
- Input and output shafts in high-strength steel
- Sizes 11, 21, and 31 with unpainted aluminum housings
- Sizes 35 – 100 with painted cast iron housings
- Sizes 11 – 41 come factory filled with synthetic lubricant and are “lubed for life.”



Size 31 Solid Shaft, input end

Size 31 Solid Shaft, output end

Size 21 NEMA C, input end

Size 21 NEMA C, output end

Viking In-Line Helical Gear Reducers

Viking In-Line helical gear reducers are available in 11 sizes and offer many ratios within each size range. All sizes and ratios offer a choice of a solid high speed input shaft or a hollow input shaft combined with a choice of NEMA C or IEC flange adaptors.

Sizes 11, 21, & 31 have aluminum housings (and aluminum flanges if NEMA C or IEC). They are shipped unpainted. Sizes 35 –100 have cast iron housings and are painted.

Sizes 11, 21, 31, 35 & 41 are supplied with lifetime lubrication (synthetic gear lubricant suitable for ambient temperatures 32 to 122°F (0 to 50°C), and do not have oil filling or oil level plugs. Sizes 51 – 100 require filling with the proper lubricant before start-up. (See TSM 615, Table 1 and Table 2.)

Additional ratios in all sizes may be available beyond those shown in this catalog section. Please consult factory for additional information.

SELECTING THE CORRECT VIKING IN-LINE HELICAL GEAR REDUCER

1. Determine the actual horsepower requirements of the application from the pump performance curve or specifications from other equipment.

2. Determine the "equivalent horsepower" for the application by multiplying the actual horsepower to be transmitted by the appropriate service factor, which can be obtained from the Service Factor Table on page 3. This service factor takes into account length of service per day, the load classification (uniform, moderate shock, heavy shock), and the type of drive. A table of driven load classifications is included to help you determine the service factor to use.

3. Find the reducer from the horsepower tables on pages 4 thru 14 which most closely matches your speed requirements. Make sure the application's equivalent horsepower (kW) for a given input speed and ratio is less than or equal to the maximum recommended horsepower (kW) shown in the chart on the "MAXIMUM REDUCER HORSEPOWER / kW" lines.

Example:

A Viking K124A requires a 7.3 HP driver at 390 rpm to deliver the desired output of 40 gpm at 200 psi on 7500 SSU fluid (from the pump curve), and is driven 24 hours per day. Using the Service Factor table, multiply the service factor (in this case 1.25) times the horsepower required (7.3 HP) for a reducer requirement of 9.13 HP.

Looking at the Specifications tables using a 1750 rpm motor, the desired 390 RPM output speed requires a gear ratio of about 4.5:1. Reviewing the Horsepower tables, we find that the Size 35 reducer with a 4.62:1 ratio (giving a 379 rpm output speed) and a 11.2 HP rating most closely meets the requirements.

Important Ordering Information:

When ordering a reducer with solid shaft input all that is required is the part number of the reducer as is provided in the pages that follow. i.e. 3-551-XXX-YYY**-00**.

When ordering a reducer with NEMA C-flange or IEC flange motor mount, you must specify the motor frame size in the last two digits of the part number. i.e: 3-551-XXX-YYY-**56** for 56C frame, or 3-551-XXX-YYY**-21** for 213TC-215TC frame motor, or 3-551-XXX-YYY–**13** for IEC 132 frame motor. The available motor flange sizes are listed at the bottom of each reducer size specification table.

Special note: Use **–10** as last two digits for IEC frames 100 and 112 as they are dimensionally interchangeable.

SERVICE FACTOR TABLE

POWER SOURCE	CLASSIFICATION OF DRIVEN LOAD*	INTERMITTENT UP TO 3 HOURS per DAY	8 – 10 HOURS per DAY	24 HOURS per DAY
Electric Motor, Steam Turbine, or Hydraulic Motor	Uniform	0.8	1.0	1.25
	Moderate Shock	1.0	1.25	1.5
	Heavy Shock	1.5	1.75	2.0
Multi-cylinder Internal Combustion Engine	Uniform	1.0	1.25	1.5
	Moderate Shock	1.25	1.5	1.75
	Heavy Shock	1.75	2.0	2.25

* Rotary Pump applications are classified as Uniform Loads.

DRIVEN LOAD CLASSIFICATIONS

(excerpted from AGMA Information Sheet 922-A96©1996)

Key: U = Uniform Load; M = Moderate Shock Load; H = Heavy Shock Load

APPLICATION	LOAD CLASSIFICATION	APPLICATION	LOAD CLASSIFICATION
Pumps, Rotary and Centrifugal	U	Fans, Cooling Tower	M
Pumps, Reciprocating	M	Feeders, Apron, Belt, Screw	U
Agitators	U	Feeders, Reciprocating	M
Blowers	U	Generators	U
Compressors, Centrifugal & Lobe	U	Hammer Mills	M
Compressors, Reciprocating	M	Machine Tools	M
Cranes and Hoists	M	Mills, Rotary	M
Crushers, Ore and Stone	H	Mixers, Concrete, Drum Type	M
Elevators	M	Printing Presses	U
Fans, Centrifugal, Forced Draft	U	Sewage Disposal Bar Screens	U

REDUCER WEIGHT

Reducer weights are shown on specification page for each reducer. The weights are approximate and are given in Lbs. (Kg). Basic frame sizes are shown but other frame sizes are included. For example, 145TC is actually for the 143TC and 145TC. Complete list is shown below.

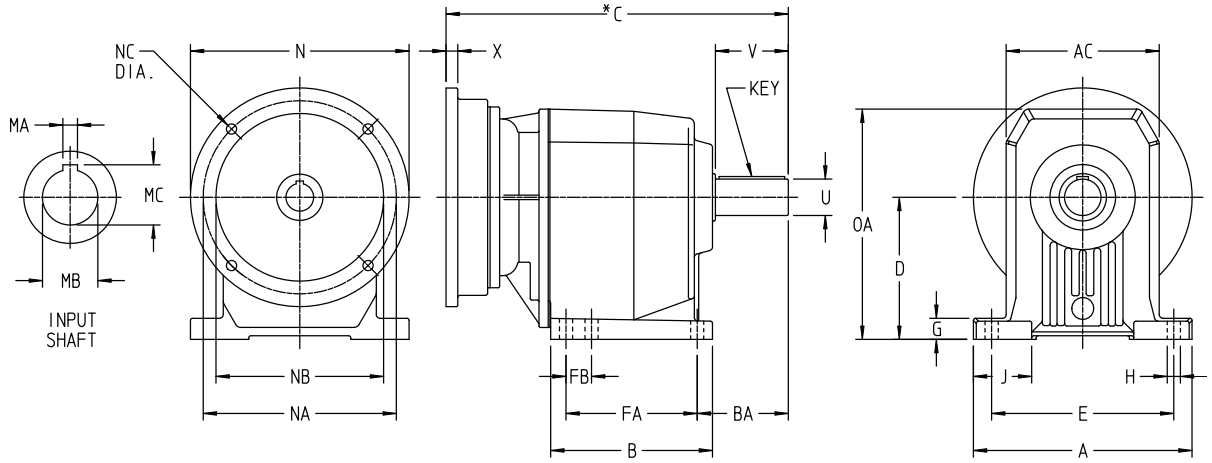
145TC = 143TC and 145TC	71 IEC = 63 IEC and 71 IEC
184TC = 182TC and 184TC	90 IEC = 80 IEC and 90 IEC
215TC = 213TC and 215TC	
256TC = 254TC and 256TC	
286TC = 284TC and 286TC	

SPECIFICATIONS: SIZE 51

Output Speed / Maximum Horsepower (kW) at Given Input Speed						
	Viking Part No.	Ratio	1750 rpm	1450 rpm	1150 rpm	950 rpm
Solid Shaft Nema C flg. IEC flg.	3-551-510-026-00 3-551-51C-026-(frame size) 3-551-51E-026-(frame size)	2.63	665 / 39.8 (29.7)	551 / 32.4 (24.1)	437 / 25.0 (18.6)	361 / 18.8 (14.0)
Solid Shaft Nema C flg. IEC flg.	3-551-510-033-00 3-551-51C-033-(frame size) 3-551-51E-033-(frame size)	3.31	529 / 32.9 (24.5)	438 / 26.8 (20.0)	347 / 20.7 (15.4)	287 / 15.5 (11.5)
Solid Shaft Nema C flg. IEC flg.	3-551-510-045-00 3-551-51C-045-(frame size) 3-551-51E-045-(frame size)	4.45	393 / 25.0 (18.6)	326 / 20.4 (15.2)	258 / 15.7 (11.7)	213 / 11.8 (8.8)
Solid Shaft Nema C flg. IEC flg.	3-551-510-056-00 3-551-51C-056-(frame size) 3-551-51E-056-(frame size)	5.63	311 / 20.1 (15.0)	257 / 16.4 (12.2)	204 / 12.6 (9.4)	169 / 9.5 (7.0)
Solid Shaft Nema C flg. IEC flg.	3-551-510-070-00 3-551-51C-070-(frame size) 3-551-51E-070-(frame size)	6.99	250 / 23.3 (17.3)	207 / 20.1 (15.0)	164 / 17.0 (12.6)	136 / 12.7 (9.4)
Solid Shaft Nema C flg. IEC flg.	3-551-510-078-00 3-551-51C-078-(frame size) 3-551-51E-078-(frame size)	7.75	222 / 21.2 (15.8)	187 / 18.3 (13.6)	148 / 15.4 (11.4)	123 / 11.6 (8.6)
Solid Shaft Nema C flg. IEC flg.	3-551-510-088-00 3-551-51C-088-(frame size) 3-551-51E-088-(frame size)	8.79	199 / 20.1 (15.0)	165 / 17.4 (13.0)	131 / 14.7 (10.9)	108 / 11.0 (8.2)
Solid Shaft Nema C flg. IEC flg.	3-551-510-098-00 3-551-51C-098-(frame size) 3-551-51E-098-(frame size)	9.75	179 / 18.1 (13.5)	149 / 15.7 (11.7)	118 / 13.3 (9.9)	97 / 10.0 (7.4)
Solid Shaft Nema C flg. IEC flg.	3-551-510-118-00 3-551-51C-118-(frame size) 3-551-51E-118-(frame size)	11.8	148 / 16.9 (12.6)	122 / 13.9 (10.3)	97 / 11.0 (8.2)	80 / 8.3 (6.2)
Solid Shaft Nema C flg. IEC flg.	3-551-510-131-00 3-551-51C-131-(frame size) 3-551-51E-131-(frame size)	13.1	134 / 14.8 (11.0)	111 / 12.4 (9.2)	88 / 9.9 (7.3)	72 / 7.4 (5.5)
Solid Shaft Nema C flg. IEC flg.	3-551-510-150-00 3-551-51C-150-(frame size) 3-551-51E-150-(frame size)	15.0	117 / 13.8 (10.3)	97 / 11.2 (8.3)	77 / 8.7 (6.5)	63 / 6.5 (4.8)
Solid Shaft Nema C flg. IEC flg.	3-551-510-166-00 3-551-51C-166-(frame size) 3-551-51E-166-(frame size)	16.6	105 / 12.4 (9.2)	87 / 10.1 (7.5)	69 / 7.8 (5.8)	57 / 5.9 (4.4)
Solid Shaft Nema C flg. IEC flg.	3-551-510-189-00 3-551-51C-189-(frame size) 3-551-51E-189-(frame size)	18.9	93 / 10.9 (8.1)	77 / 8.9 (6.6)	61 / 6.9 (5.1)	50 / 5.2 (3.8)
Solid Shaft Nema C flg. IEC flg.	3-551-510-210-00 3-551-51C-210-(frame size) 3-551-51E-210-(frame size)	21.0	83 / 9.8 (7.3)	69 / 8.0 (5.9)	55 / 6.2 (4.6)	45 / 5.2 (3.8)
Solid Shaft Nema C flg. IEC flg.	3-551-510-234-00 3-551-51C-234-(frame size) 3-551-51E-234-(frame size)	23.4	75 / 8.8 (6.5)	62 / 7.2 (5.3)	49 / 5.6 (4.1)	41 / 4.2 (3.1)
Solid Shaft Nema C flg. IEC flg.	3-551-510-259-00 3-551-51C-259-(frame size) 3-551-51E-259-(frame size)	25.9	68 / 7.9 (5.9)	56 / 6.5 (4.8)	44 / 5.0 (3.7)	37 / 3.8 (2.8)
Solid Shaft Nema C flg. IEC flg.	3-551-510-298-00 3-551-51C-298-(frame size) 3-551-51E-298-(frame size)	29.8	59 / 6.9 (5.1)	49 / 5.7 (4.2)	39 / 4.4 (3.2)	32 / 3.3 (2.4)
Solid Shaft Nema C flg. IEC flg.	3-551-510-330-00 3-551-51C-330-(frame size) 3-551-51E-330-(frame size)	33.0	53 / 6.2 (4.6)	44 / 5.1 (3.8)	35 / 3.9 (2.9)	29 / 3.0 (2.2)

Size 51 Approx. weights	Weights – Lbs. (Kg)				
	Solid Shaft	184TC & 112 IEC	215TC & 132 IEC	256TC & 160 IEC	286TC & 180 IEC
	99 (45)	117(53)	119 (54)	128 (58)	133 (61)

NEMA "C" Face Model Dimensions



Size		A	AC	B	BA	D	E	FA	FB	G	H	J	OA	V	U	KEY
11	in	5.12	3.74	4.21	2.28	3.35	4.33	3.43	1.46	.59	.35	1.46	5.55	1.56	0.750	.19x.19x1.38
	mm	130	95	107	58	85	110	87	37	15	9	37	141	40	n.a.	n.a.
21	in	6.10	4.33	5.39	2.68	3.94	5.12	4.23	1.87	.67	.43	1.77	6.54	2.00	1.000	.25x.25x1.75
	mm	155	110	137	68	100	130	107.5	47.5	17	11	45	166	50	n.a.	n.a.
31	in	7.48	5.12	6.14	3.07	4.33	6.30	5.12	2.36	.79	.43	2.09	7.13	2.38	1.125	.25x.25x2.16
	mm	190	130	156	78	110	160	130	60	20	11	53	181	60	n.a.	n.a.
35	in	8.07	5.91	6.61	3.58	4.53	6.69	5.12	n.a.	.63	.55	1.97	8.11	2.71	1.375	.31x.31x2.38
	mm	205	150	168	93.5	115	170	130	n.a.	16	14	50	206	69	n.a.	n.a.
41	in	8.50	6.10	7.30	3.52	5.12	7.09	5.88	n.a.	.71	.55	2.40	8.70	2.71	1.375	.31x.31x2.38
	mm	216	155	185.5	89.5	130	180	149.5	n.a.	18	14	61	221	69	n.a.	n.a.
51	in	10.63	7.28	7.87	4.13	6.10	8.86	6.14	n.a.	.87	.71	2.95	10.94	3.12	1.562	.38x.38x2.88
	mm	270	185	200	105	155	225	178	n.a.	22	18	75	278	80	n.a.	n.a.
61	in	11.81	8.27	9.13	4.36	7.68	9.84	7.09	n.a.	.98	.71	3.15	12.44	3.38	2.000	.50x.50x3.16
	mm	300	210	232	111	195	250	180	n.a.	25	18	80	316	86	n.a.	n.a.

NEMA FRAME		N	NA	NB	NC	X	MA	MB	MC
56C	in	6.496	5.875	4.50	.39	.47	.188	.625	.71
143TC, 145TC	in	6.496	5.875	4.50	.39	.47	.188	.875	.96
182TC, 184TC	in	8.996	7.250	8.50	.55	.63	.250	1.125	1.24
213TC, 215TC	in	8.996	7.250	8.50	.55	.63	.312	1.375	1.52
254TC, 256TC	in	13.780	7.250	8.500	.55	.75	.375	1.625	1.80
284TC, 286TC	in	13.780	9.000	10.500	.55	.75	.500	1.875	2.10

* See Page 19 for "C" Dimensions

"C" Dimensions

NEMA C-Face Models (from page 17)

Size		56C /143TC /145TC	182/184TC	213/215TC	254/256 TC	284/286 TC
11	in	**10.41**	**10.95**	n.a	n.a.	n.a.
	mm	264.5	278			
21	in	**11.57**	**12.10**	n.a.	n.a.	n.a.
	mm	293.8	307.3			
31	in	**12.89**	**13.39**	n.a.	n.a.	n.a.
	mm	327.5	340			
35	in	**13.62**	**14.15**	**15.56**	n.a.	n.a.
	mm	346	359.5	395.4		
41	in	**14.04**	**14.57**	**16.02**	n.a.	n.a.
	mm	356.5	370	407		
51	in	**15.03**	**15.56**	**16.80**	**19.83**	**20.01**
	mm	381.8	395.3	426.8	503.8	508.3
61	in	**17.11**	**17.65**	**18.89**	**21.37**	**21.56**
	mm	434.7	448.2	479.7	542.8	547.6

IEC Flange Models (from page 18)

Size		63	71	80	90	100	112	132	160	180
11	in	**9.63**	**9.63**	**10.39**	**10.39**	**10.79**	**10.79**	n.a.	n.a.	n.a.
	mm	244.5	244.5	264	264	274	274			
21	in	**10.75**	**10.75**	**11.52**	**11.52**	**11.91**	**11.91**	n.a.	n.a.	n.a.
	mm	273	273	292.5	292.5	302.5	302.5			
31	in	**12.11**	**12.11**	**12.88**	**12.88**	**13.27**	**13.27**	n.a.	n.a.	n.a.
	mm	307.5	307.5	327	327	337	337			
35	in	**12.84**	**12.84**	**13.60**	**13.60**	**14.00**	**14.00**	n.a.	n.a.	n.a.
	mm	326	326	345.5	345.5	355.5	355.5			
41	in	n.a.	**13.25**	**14.02**	**14.02**	**14.41**	**14.41**	**15.85**	n.a.	n.a.
	mm		336.5	356	356	366	366	402.5		
51	in	n.a.	**14.27**	**15.04**	**15.04**	**15.43**	**15.43**	**16.87**	**18.86**	**18.86**
	mm		362.5	382	382	392	392	428.5	479	479
61	in	n.a.	n.a.	**16.54**	**16.54**	**16.89**	**16.89**	**18.37**	**20.35**	**20.35**
	mm			420	420	429	429	466.5	517	517

Viking In-Line Helical Gear Reducers

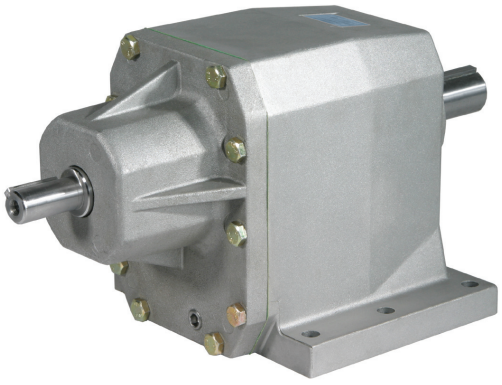
Section	615
Page	615.1
Issue	C

Gear Ratio Range: (varies by reducer size)	From 2.63:1 to 38.0:1 (Varies by reducer size)
Output Speeds (with 1750 rpm input)	46 – 665 rpm
Reducer Horsepower Range:	.5 HP (.37 kW) to 350 HP (261 kW)

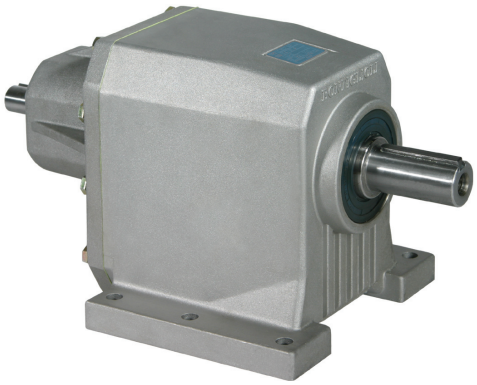
Major Design Features

Features:

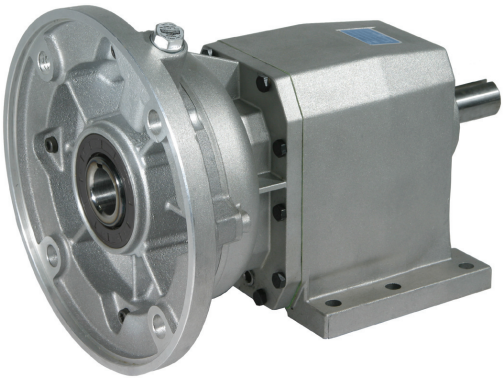
- Available in eleven different sizes and a variety of ratios, all double reduction
- Compact design
- Universal mounting
  - solid input shaft
  - hollow input shaft with NEMA C or IEC Flange Mount Option
- High efficiency
- Low noise levels
- Gears in hardened and case-hardened steel
- Input and output shafts in high-strength steel
- Sizes 11, 21, and 31 with unpainted aluminum housings
- Sizes 35 – 100 with painted cast iron housings
- Sizes 11 – 41 come factory filled with synthetic lubricant and are “lubed for life.”



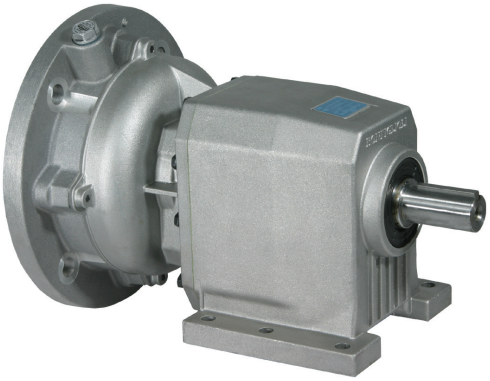
Size 31 Solid Shaft, input end



Size 31 Solid Shaft, output end



Size 21 NEMA C, input end



Size 21 NEMA C, output end

Viking In-Line Helical Gear Reducers

Viking In-Line helical gear reducers are available in 11 sizes and offer many ratios within each size range. All sizes and ratios offer a choice of a solid high speed input shaft or a hollow input shaft combined with a choice of NEMA C or IEC flange adaptors.

Sizes 11, 21, & 31 have aluminum housings (and aluminum flanges if NEMA C or IEC). They are shipped unpainted. Sizes 35 –100 have cast iron housings and are painted.

Sizes 11, 21, 31, 35 & 41 are supplied with lifetime lubrication (synthetic gear lubricant suitable for ambient temperatures 32 to 122°F (0 to 50°C), and do not have oil filling or oil level plugs. Sizes 51 – 100 require filling with the proper lubricant before start-up. (See TSM 615, Table 1 and Table 2.)

Additional ratios in all sizes may be available beyond those shown in this catalog section. Please consult factory for additional information.

SELECTING THE CORRECT VIKING IN-LINE HELICAL GEAR REDUCER

1. Determine the actual horsepower requirements of the application from the pump performance curve or specifications from other equipment.

2. Determine the "equivalent horsepower" for the application by multiplying the actual horsepower to be transmitted by the appropriate service factor, which can be obtained from the Service Factor Table on page 3. This service factor takes into account length of service per day, the load classification (uniform, moderate shock, heavy shock), and the type of drive. A table of driven load classifications is included to help you determine the service factor to use.

3. Find the reducer from the horsepower tables on pages 4 thru 14 which most closely matches your speed requirements. Make sure the application's equivalent horsepower (kW) for a given input speed and ratio is less than or equal to the maximum recommended horsepower (kW) shown in the chart on the "MAXIMUM REDUCER HORSEPOWER / kW" lines.

Example:

A Viking K124A requires a 7.3 HP driver at 390 rpm to deliver the desired output of 40 gpm at 200 psi on 7500 SSU fluid (from the pump curve), and is driven 24 hours per day. Using the Service Factor table, multiply the service factor (in this case 1.25) times the horsepower required (7.3 HP) for a reducer requirement of 9.13 HP.

Looking at the Specifications tables using a 1750 rpm motor, the desired 390 RPM output speed requires a gear ratio of about 4.5:1. Reviewing the Horsepower tables, we find that the Size 35 reducer with a 4.62:1 ratio (giving a 379 rpm output speed) and a 11.2 HP rating most closely meets the requirements.

Important Ordering Information:

When ordering a reducer with solid shaft input all that is required is the part number of the reducer as is provided in the pages that follow. i.e. 3-551-XXX-YYY**-00**.

When ordering a reducer with NEMA C-flange or IEC flange motor mount, you must specify the motor frame size in the last two digits of the part number. i.e: 3-551-XXX-YYY-**56** for 56C frame, or 3-551-XXX-YYY**-21** for 213TC-215TC frame motor, or 3-551-XXX-YYY**–13** for IEC 132 frame motor. The available motor flange sizes are listed at the bottom of each reducer size specification table.

Special note: Use **–10** as last two digits for IEC frames 100 and 112 as they are dimensionally interchangeable.

SERVICE FACTOR TABLE

POWER SOURCE	CLASSIFICATION OF DRIVEN LOAD*	INTERMITTENT UP TO 3 HOURS per DAY	8 – 10 HOURS per DAY	24 HOURS per DAY
Electric Motor, Steam Turbine, or Hydraulic Motor	Uniform	0.8	1.0	1.25
	Moderate Shock	1.0	1.25	1.5
	Heavy Shock	1.5	1.75	2.0
Multi-cylinder Internal Combustion Engine	Uniform	1.0	1.25	1.5
	Moderate Shock	1.25	1.5	1.75
	Heavy Shock	1.75	2.0	2.25

* Rotary Pump applications are classified as Uniform Loads.

DRIVEN LOAD CLASSIFICATIONS

(excerpted from AGMA Information Sheet 922-A96©1996)

Key: U = Uniform Load; M = Moderate Shock Load; H = Heavy Shock Load

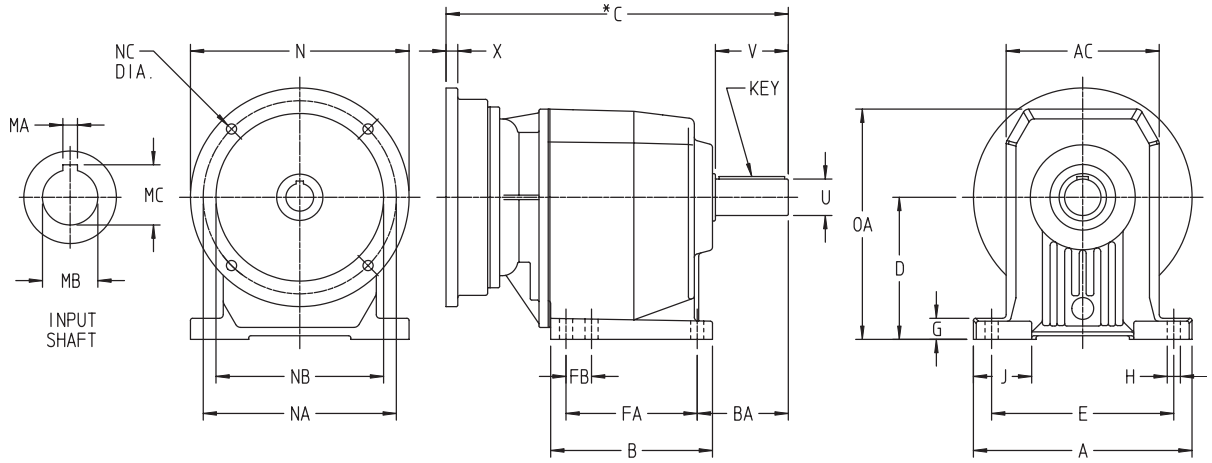
APPLICATION	LOAD CLASSIFICATION	APPLICATION	LOAD CLASSIFICATION
Pumps, Rotary and Centrifugal	U	Fans, Cooling Tower	M
Pumps, Reciprocating	M	Feeders, Apron, Belt, Screw	U
Agitators	U	Feeders, Reciprocating	M
Blowers	U	Generators	U
Compressors, Centrifugal & Lobe	U	Hammer Mills	M
Compressors, Reciprocating	M	Machine Tools	M
Cranes and Hoists	M	Mills, Rotary	M
Crushers, Ore and Stone	H	Mixers, Concrete, Drum Type	M
Elevators	M	Printing Presses	U
Fans, Centrifugal, Forced Draft	U	Sewage Disposal Bar Screens	U

REDUCER WEIGHT

Reducer weights are shown on specification page for each reducer. The weights are approximate and are given in Lbs. (Kg). Basic frame sizes are shown but other frame sizes are included. For example, 145TC is actually for the 143TC and 145TC. Complete list is shown below.

145TC = 143TC and 145TC	71 IEC = 63 IEC and 71 IEC
184TC = 182TC and 184TC	90 IEC = 80 IEC and 90 IEC
215TC = 213TC and 215TC	
256TC = 254TC and 256TC	
286TC = 284TC and 286TC	

NEMA "C" Face Model Dimensions



Size		A	AC	B	BA	D	E	FA	FB	G	H	J	OA	V	U	KEY
11	in	5.12	3.74	4.21	2.28	3.35	4.33	3.43	1.46	.59	.35	1.46	5.55	1.56	0.750	.19x.19x1.38
	mm	130	95	107	58	85	110	87	37	15	9	37	141	40	n.a.	n.a.
21	in	6.10	4.33	5.39	2.68	3.94	5.12	4.23	1.87	.67	.43	1.77	6.54	2.00	1.000	.25x.25x1.75
	mm	155	110	137	68	100	130	107.5	47.5	17	11	45	166	50	n.a.	n.a.
31	in	7.48	5.12	6.14	3.07	4.33	6.30	5.12	2.36	.79	.43	2.09	7.13	2.38	1.125	.25x.25x2.16
	mm	190	130	156	78	110	160	130	60	20	11	53	181	60	n.a.	n.a.
35	in	8.07	5.91	6.61	3.58	4.53	6.69	5.12	n.a.	.63	.55	1.97	8.11	2.71	1.375	.31x.31x2.38
	mm	205	150	168	93.5	115	170	130	n.a.	16	14	50	206	69	n.a.	n.a.
41	in	8.50	6.10	7.30	3.52	5.12	7.09	5.88	n.a.	.71	.55	2.40	8.70	2.71	1.375	.31x.31x2.38
	mm	216	155	185.5	89.5	130	180	149.5	n.a.	18	14	61	221	69	n.a.	n.a.
51	in	10.63	7.28	7.87	4.13	6.10	8.86	6.14	n.a.	.87	.71	2.95	10.94	3.12	1.562	.38x.38x2.88
	mm	270	185	200	105	155	225	178	n.a.	22	18	75	278	80	n.a.	n.a.
61	in	11.81	8.27	9.13	4.36	7.68	9.84	7.09	n.a.	.98	.71	3.15	12.44	3.38	2.000	.50x.50x3.16
	mm	300	210	232	111	195	250	180	n.a.	25	18	80	316	86	n.a.	n.a.

NEMA FRAME		N	NA	NB	NC	X	MA	MB	MC
56C	in	6.496	5.875	4.50	.39	.47	.188	.625	.71
143TC, 145TC	in	6.496	5.875	4.50	.39	.47	.188	.875	.96
182TC, 184TC	in	8.996	7.250	8.50	.55	.63	.250	1.125	1.24
213TC, 215TC	in	8.996	7.250	8.50	.55	.63	.312	1.375	1.52
254TC, 256TC	in	13.780	7.250	8.500	.55	.75	.375	1.625	1.80
284TC, 286TC	in	13.780	9.000	10.500	.55	.75	.500	1.875	2.10

* See Page 19 for "C" Dimensions

"C" Dimensions

NEMA C-Face Models

Size		56C /143TC /145TC	182/184TC	213/215TC	254/256 TC	284/286 TC
11	in	**10.41**	**10.95**	n.a	n.a.	n.a.
	mm	264.5	278			
21	in	**11.57**	**12.10**	n.a.	n.a.	n.a.
	mm	293.8	307.3			
31	in	**12.89**	**13.39**	n.a.	n.a.	n.a.
	mm	327.5	340			
35	in	**13.62**	**14.15**	n.a.	n.a.	n.a.
	mm	346	359.5			
41	in	**14.04**	**14.57**	**16.02**	n.a.	n.a.
	mm	356.5	370	407		
51	in	**15.03**	**15.56**	**16.80**	**19.83**	**20.01**
	mm	381.8	395.3	426.8	503.8	508.3
61	in	**17.11**	**17.65**	**18.89**	**21.37**	**21.56**
	mm	434.7	448.2	479.7	542.8	547.6

IEC Flange Models (from page 18)

Size		63	71	80	90	100	112	132	160	180
11	in	**9.63**	**9.63**	**10.39**	**10.39**	**10.79**	**10.79**	n.a	n.a.	n.a.
	mm	244.5	244.5	264	264	274	274			
21	in	**10.75**	**10.75**	**11.52**	**11.52**	**11.91**	**11.91**	n.a.	n.a.	n.a.
	mm	273	273	292.5	292.5	302.5	302.5			
31	in	**12.11**	**12.11**	**12.88**	**12.88**	**13.27**	**13.27**	n.a.	n.a.	n.a.
	mm	307.5	307.5	327	327	337	337			
35	in	**12.84**	**12.84**	**13.60**	**13.60**	**14.00**	**14.00**	n.a.	n.a.	n.a.
	mm	326	326	345.5	345.5	355.5	355.5			
41	in	n.a.	**13.25**	**14.02**	**14.02**	**14.41**	**14.41**	**15.85**	n.a.	n.a.
	mm		336.5	356	356	366	366	402.5		
51	in	n.a.	**14.27**	**15.04**	**15.04**	**15.43**	**15.43**	**16.87**	**18.86**	**18.86**
	mm		362.5	382	382	392	392	428.5	479	479
61	in	n.a.	n.a.	**16.54**	**16.54**	**16.89**	**16.89**	**18.37**	**20.35**	**20.35**
	mm			420	420	429	429	466.5	517	517

I Section 11342: Carbon Recirculation Pumps
D. In-Line Base Coupling and Guard

TB Wood's

SECTION
F1

SURE-FLEX® ELASTOMERIC COUPLINGS

- **Need No Lubrication, No Maintenance**
- **Quick, Easy Installation**
- **Clean, Quiet Performance**

TB WOOD'S INCORPORATED ■ Chambersburg, Pennsylvania 17201
T.B. WOOD'S CANADA LTD. ■ Stratford, Ontario N5A 6V6

SURE-FLEX CAPABILITIES

4-WAY FLEXING ACTION absorbs all types of shock, vibration and misalignment

TORSIONAL

Sure-Flex coupling sleeves have an exceptional ability to absorb torsional shock and dampen torsional vibrations. The EPDM and Neoprene sleeves wind-up approximately 15° torsionally at their rated torque. Hytrel sleeves will wind-up about 7°.

ANGULAR

The unique design of the Sure-Flex coupling's teeth allows for the absorption of angular misalignment without wear. Refer to page F1—18 for actual allowable misalignment limits. These limits allow for the alignment of the coupling using only a scale and calipers.

PARALLEL

Parallel misalignment is absorbed without wear or appreciable energy losses. The lateral flexibility of the coupling sleeve minimizes radial bearing loads normally associated with parallel misalignment. This feature also allows for easier installation by the use of components bored for slip fits without fretting corrosion occurring at the shaft. Refer to page F1—18 for parallel misalignment limits. Only a straight-edge and feeler gage are required to obtain these limits.

AXIAL

Sure-Flex couplings may be used in applications with limited axial shaft movements. The axial compressibility of the EPDM and Neoprene sleeves allows for shaft end-float without the absolute transfer of thrust loads.

EASY, QUICK INSTALLATION

Sure-Flex can be installed quickly and easily, because there are no bolts, gaskets, covers or seals. Alignment can be checked with a straightedge placed across the outside of the precision-machined flanges. No special tools are needed for installation, alignment or removal.

NO LUBRICATION, TROUBLE-FREE OPERATION

The teeth of the sleeve lock into the teeth of the flanges without clamps or screws, tightening under torque to provide smooth transmission of power. There is no rubbing action of metal against rubber to cause wear. Couplings are not affected by abrasives, dirt, or moisture. This eliminates the need for lubrication or maintenance, provides clean, dependable, quiet performance.

SURE-FLEX SELECTION

Sure-Flex couplings are selected as component parts.

1. Determine SLEEVE material and type.
   Refer to pages F1—4 & 5
2. Determine coupling SIZE.
   Refer to pages F1—6, 7, & 8
3. Determine FLANGES to be used.
   Refer to pages F1—9 thru 16

Specify coupling components.

- Example #1 - Close coupled
  - Size 6, Type S flange w 1-3/8 bore
  - Size 6, Type S flange w 1” bore
  - Size 6, Solid EPDM sleeve
- Example #2 - 5” Between shaft spacer
  - Size 9, Type SC flange for #11 hub
  - Size 9, Type SC flange for #9 hub
  - Size 11 hub w 2-3/8 bore
  - Size 9 short hub w 1-1/8 bore
  - Size 9 Solid Hytrel sleeve

PROD. NUMBER	PROD. DESCRIPTION
6S138	6Sx1-3/8
6S1	6Sx1
6J	6JE
9SC5011	9SC50-11
9SC50	9SC50
11SCH238	11SCH x 2-3/8
9SCHS118	9SCHS x 1-1/8
9H	9H

SURE-FLEX SLEEVE SELECTION

TB Wood's

Sure-Flex Sleeves are available in four materials or compounds and various shape configurations.

	EPDM	Neoprene	Hytrel	Urethane
CONSTRUCTIONS AVAILABLE				
1 pc, unsplit	JE	JN	H	U
1 pc, split	JES	JNS	—	—
2 piece	E	N	HS	—
TYPICAL USE	General Purpose	Oil Resist Non-flame	General Purpose	Stiffness
REL. RATING	1X	1X	4X	4X
WIND-UP ANGULAR	15°	15°	7°	3°
MISALIGN	1°	1°	1/4°	1/4°
TEMPERATURE (F)				
maximum	+275°	+200°	+250°	+200°
minimum	–30°	–0°	–65°	–80°

SURE-FLEX SLEEVES

Product No.	Product Description
3J	3JE EPDM
4J	4JE EPDM
5J	5JE EPDM
6J	6JE EPDM
7J	7JE EPDM
8J	8JE EPDM
9J	9JE EPDM
10J	10JE EPDM
3JS	3JES EPDM Split
4JS	4JES EPDM Split
5JS	5JES EPDM Split
6JS	6JES EPDM Split
7JS	7JES EPDM Split
8JS	8JES EPDM Split
9JS	9JES EPDM Split
10JS	10JES EPDM Split
3JN	3JN Neoprene
4JN	4JN Neoprene
5JN	5JN Neoprene
6JN	6JN Neoprene
7JN	7JN Neoprene
8JN	8JN Neoprene
3JNS	3JNS Neoprene Split
4JNS	4JNS Neoprene Split
5JNS	5JNS Neoprene Split
6JNS	6JNS Neoprene Split
7JNS	7JNS Neoprene Split
8JNS	8JNS Neoprene Split

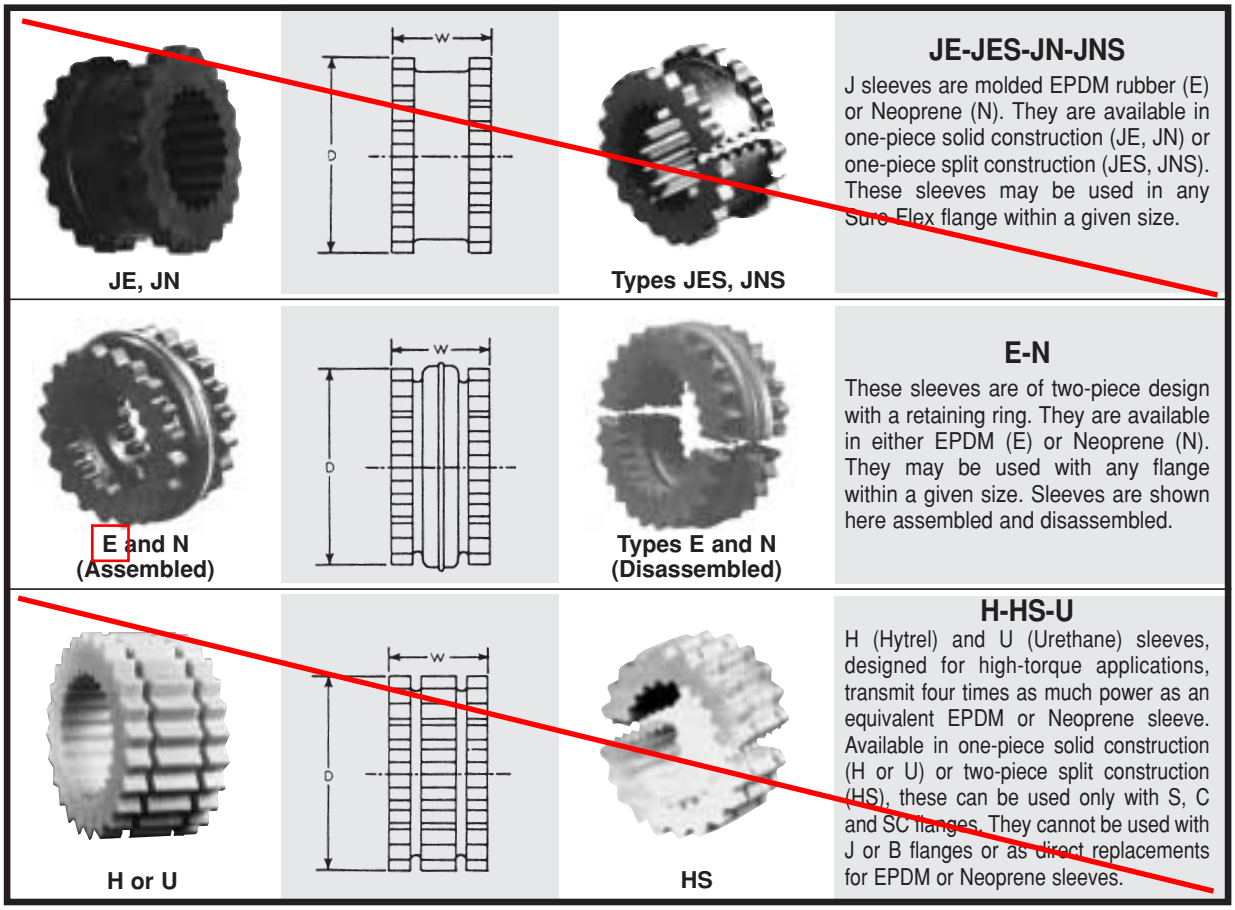
Product No.	Product Description
4	4E EPDM
5	5E EPDM
6	6E EPDM
7	7E EPDM
8	8E EPDM
9	9E EPDM
10	10E EPDM
11	11E EPDM
12	12E EPDM
13	13E EPDM
14	14E EPDM
16	16E EPDM
4N	4N Neoprene
5N	5N Neoprene
6N	6N Neoprene
7N	7N Neoprene
8N	8N Neoprene
9N	9N Neoprene
10N	10N Neoprene
11N	11N Neoprene
12N	12N Neoprene
13N	13N Neoprene
14N	14N Neoprene

Product No.	Product Description
6H	6H Hytrel
7H	7H Hytrel
8H	8H Hytrel
9H	9H Hytrel
10H	10H Hytrel
11H	11H Hytrel
12H	12H Hytrel
6HS	6HS Split Hytrel
7HS	7HS Split Hytrel
8HS	8HS Split Hytrel
9HS	9HS Split Hytrel
10HS	10HS Split Hytrel
11HS	11HS Split Hytrel
12HS	12HS Split Hytrel
13HS	13HS Split Hytrel
14HS	14HS Split Hytrel
10U	10U Urethane
11U	11U Urethane
12U	12U Urethane

SURE-FLEX SLEEVE SELECTION

TB Wood's

Flexible sleeves for Wood's Sure-Flex couplings are available in four materials (EPDM Neoprene, Hytrel and Urethane) and in three basic constructions. Characteristics of the materials are given on page F1—4 and the various types are shown and described here.



JE-JES-JN-JNS

J sleeves are molded EPDM rubber (E) or Neoprene (N). They are available in one-piece solid construction (JE, JN) or one-piece split construction (JES, JNS). These sleeves may be used in any Sure-Flex flange within a given size.

E-N

These sleeves are of two-piece design with a retaining ring. They are available in either EPDM (E) or Neoprene (N). They may be used with any flange within a given size. Sleeves are shown here assembled and disassembled.

H-HS-U

H (Hytrel) and U (Urethane) sleeves, designed for high-torque applications, transmit four times as much power as an equivalent EPDM or Neoprene sleeve. Available in one-piece solid construction (H or U) or two-piece split construction (HS), these can be used only with S, C and SC flanges. They cannot be used with J or B flanges or as direct replacements for EPDM or Neoprene sleeves.

DIMENSIONS (in.)

Coupling Size	JE, JES, JN & JNS Sleeves EPDM & Neoprene			E and N Sleeves EPDM & Neoprene			H, U & HS Sleeves Hytrel & Urethane		
	D	W	Wt. (lbs.)	D	W	Wt. (lbs.)	D	W	Wt. (lbs.)
3	1 7/8	1	.06	. . .	. . .	. . .	. . .	. . .	. . .
4	2 5/16	1 1/4	.10	2 5/16	1 1/4	.11	. . .	. . .	. . .
5	2 15/16	1 9/16	.20	2 15/16	1 9/16	.25	. . .	. . .	. . .
6	3 3/4	1 7/8	.40	3 3/4	1 7/8	.49	3 3/4	1 7/8	.44
7	4 11/32	2 3/16	.62	4 11/32	2 3/16	.77	4 11/32	2 3/16	.69
8	5 1/16	2 1/2	1.13	5 1/16	2 1/2	1.4	5 1/16	2 1/2	1.4
9*	6	3	1.46	6	3	2.0	6	3	1.8
10*	7 1/16	3 7/16	2.32	7 1/16	3 7/16	3.2	7 1/16	3 7/16	2.9
11	. . .	. . .	. . .	8 3/16	4	5.1	8 3/16	4	4.5
12	. . .	. . .	. . .	9 9/16	4 11/16	8.1	9 9/16	4 11/16	7.3
13	. . .	. . .	. . .	11 3/16	5 1/2	13.0	11 3/16	5 1/2	11.8
14	. . .	. . .	. . .	13 3/32	6 1/2	21.1	13 3/32	6 1/2	19.3
16	. . .	. . .	. . .	17 29/32	8 3/4	45.3	. . .	. . .	. . .

The 13 and 14 Hytrel available with HS sleeves only.

*All 9J and 10J sleeves available in EPDM only. Only sizes available in Urethane.

SURE-FLEX COUPLING SIZE SELECTION

TB Wood's

1. Select Load Symbol based on your driveN machine.

Application	Load Symbol
AGITATORS—Paddle, Propeller, Screw	L
BAND RESAW (lumber)	M
BARGE HAUL PULLER	H
BARKING (lumber)	H
BAR SCREEN (sewage)	L
BATCHES (textile)	L
BEATER AND PULPER (paper)	M
BENDING ROLL (metal)	M
BLEACHER (paper)	L
BLOWERS	
Centrifugal, Vane	L
Lobe	M
BOTTLING MACHINERY	L
BREW KETTLES (distilling)	L
BUCKET ELEVATOR OR CONVEYOR	M
CALENDERS	
Calendar (paper)	M
Calender-super (paper), Calender (rubber)	H
CANE KNIVES (sugar)	M
CARD MACHINE (textile)	H
CAR DUMPERS	H
CAR PULLERS	M
CEMENT KILN	H
CENTRIFUGAL BLOWERS, COMPRESSORS, FANS or PUMPS	L
CHEMICAL FEEDERS (sewage)	L
CHILLER (oil)	M
CHIPPER (paper)	H
CIRCULAR RESAW (lumber)	M
CLARIFIER or CLASSIFIER	L
CLAY WORKING MACHINERY	M
COLLECTORS (sewage)	L
COMPRESSORS	
Centrifugal	L
Reciprocating	*
Screw, Lobe	L
CONCRETE MIXERS	M
CONVERTING MACHINE (paper)	M
CONVEYORS	
Apron, Assembly Belt, Flight, Oven, Screw	L
Bucket	M
COOKERS—Brewing, Distilling, Food	L
COOLING TOWER FANS	H
COUCH (paper)	M
CRANES and HOISTS	M
Heavy Duty Mine	H
CRUSHERS—Cane (sugar), Stone or Ore	H
CUTTER—Paper	H
CYLINDER (paper)	H
DEWATERING SCREEN (sewage)	M
DISC FEEDER	L
DOUGH MIXER	M
DRAW BENCH CONVEYOR and MAIN DRIVE	H
DREDGES	
Cable Reel, Pumps	M
Cutter Head Drive, Jig Drive, Screen Drive	H
Maneuvering and Utility Winch, Stacker	M
DYNAMOMETER	L
DRYERS (rotary)	M
EDGER (lumber)	H
ELEVATOR	
Bucket	M
Escalator	L
Freight, Passenger, Service, Man Lift	H
ESCALATORS	L
EXTRUDER (metal)	H
FANS	
Centrifugal	L
Cooling Tower	H
Forced Draft, Large Industrial or Mine	M
FEEDERS	
Apron, Belt, Disc	L
Reciprocating	H
Screw	M
FILTER, PRESS-OIL	M
GENERATORS	
Uniform load	L
Varying load, Hoist	M
Welders	H
GRIT COLLECTOR (sewage)	L
GRIZZLY	H
HAMMERMILL	
Light Duty, Intermittent	M
Heavy Duty, Continuous	H
HOISTS	
Heavy Duty	H
Medium Duty	M
JORDAN (paper)	H
KILN, ROTARY	H
LAUNDRY WASHER or TUMBLER	H
LINE SHAFTS	L
LOG HAUL (lumber)	H
LOOM (textile)	M
MACHINE TOOLS, MAIN DRIVE	M
MANGLE (textile)	L
MASH TUBS (distilling)	L
MEAT GRINDER	M
METAL FORMING MACHINES	M
MILLS	
Ball, Pebble, Rod, Tube, Rubber Tumbling	H
Dryer and Cooler	M
MIXERS	
Concrete, Muller	M
Banbury	H
ORE CRUSHER	H
OVEN CONVEYOR	L
PLANER (metal or wood)	M
PRESSES	
Brick, Briquette Machine	H
Notching, Paper, Punch, Printing	M
PUG MILL	M
PULP GRINDER (paper)	H
PULVERIZERS	
Hammermill—light duty, Roller	M
Hammermill—heavy duty, Hog	H
PUMPS	
Centrifugal, Axial	L
Gear, Lobe, Vane	M
Reciprocating—sgl. or dbl. acting, cylinder	*
REEL, REWINDER (paper) CABLE	M
ROD MILL	H
SAWDUST CONVEYOR	L
SCREENS	
Air Washing, Water	L
Rotary for coal or sand	M
Vibrating	H
SCREW CONVEYOR	L
SLAB CONVEYOR (lumber)	M
SLITTERS (metal)	M
SOAPERS (textile)	L
SORTING TABLE (lumber)	M
SPINNER (textile)	M
STOKER	L
SUCTION ROLL (paper)	M
TENTER FRAMES (textile)	M
TIRE BUILDING MACHINES	H
TIRE & TUBE PRESS OPENER	L
TUMBLING BARRELS	H
WASHER and THICKENER (paper)	M
WINCHES	M
WINDERS, Paper, Textile, Wire	M
WINDLASS	M
WIRE	
Drawing	H
Winding	M
WOODWORKING MACHINERY	L

*Consult Factory

2. Determine Service Factor using Load Symbol and driveR.

Load Symbol	L Light	M Medium	H Heavy
Standard AC Motor DC Shunt Motor *Engine, 8 or more cylinders	1.25	1.5	2.0
High Torque AC Motor DC Series & Comp. *Engine, 4-6 cylinders	1.5	2.0	2.5
*Engine, 3 cylinders or less	2.0	2.5	3.0
Turbine	1.0	1.25	1.5

*On applications involving varying torque loads, design around the maximum load. Then determine the resulting service factor at minimum load. If this value is greater than 4.0, special coupling alignment will be required (see page F1—18).

Caution: Applications involving reciprocating engines and reciprocating driven devices are subject to rotational vibrational critical speeds which may destroy the coupling. The factory can determine these speeds when the rotational inertia (WR^2) of the driveR and driveN units is known.

3. If coupling to the shaft of a 60 HZ AC motor, you may refer to page 8, locate the correct chart & columns for your sleeve material, motor speed and service factor; you can read the coupling size across from the motor horsepower.

Example: For 150 HP @ 1750 RPM and 1.5 Service Factor - Use #13 EPDM or Neoprene or #10 Hytrel or Urethane.

4. For other speeds, use the following formula to calculate the required coupling horsepower rating @ 100 rpm.

HP @ 100 rpm = HP x Service Factor x 100 / coupling RPM

5. Use the chart below to find a coupling with a HP @ 100 RPM rating which is greater than calculated above.

Example: For 5 HP @ 55 RPM and 1.25 Service Factor:

HP @ 100 = 5 x 1.25 x 100 / 55 = 11.36
Use #12 EPDM or Neoprene or #9 Hytrel with rating of 11.4 HP.

COUPLING RATINGS

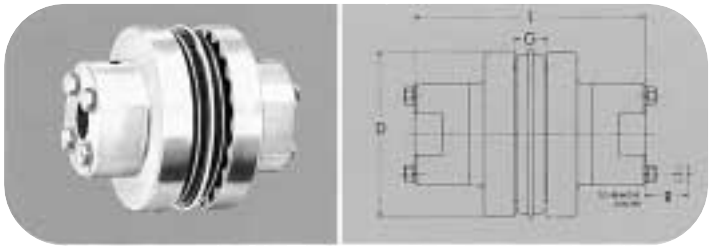
Size	EPDM Sleeves	Neoprene Sleeves	HP @ RPM				Torque (in. lbs.)	Stiffness (in. lbs./rad)	Max RPM
			100	1160	1750	3500			
3	JE,JES	JN,JNS	0.1	1.1	1.7	3.3	60	229	9200
4	E,JE,JES	N,JN,JNS	0.2	2.2	3.3	6.7	120	458	7600
5	E,JE,JES	N,JN,JNS	0.4	4.4	6.7	13	240	916	7600
6	E,JE,JES	N,JN,JNS	0.7	8.3	12.5	25	450	1718	6000
7	E,JE,JES	N,JN,JNS	1.2	13	20	40	725	2769	5250
8	E,JE,JES	N,JN,JNS	1.8	20	32	63	1135	4335	4500
9	E,JE,JES	N	2.9	33	50	100	1800	6875	3750
10	E,JE,JES	N	4.6	53	80	160	2875	10980	3600
11	E	N	7.2	83	126	252	4530	17300	3600
12	E	N	11.4	132	200		7200	27500	2800
13	E	N	18.0	209	315		11350	43350	2400
14	E	N	28.6	331	500		18000	68755	2200
16	E		75.0	870			47250	180480	1500

Size	Hytrel Sleeves	Urethane Sleeves	HP @ RPM				Torque (in. lbs.)	Stiffness (in. lbs./rad)	Max RPM
			100	1160	1750	3500			
6	H, HS		2.9	33	50	100	1800	10000	6000
7	H, HS		4.6	53	80	160	2875	20000	5250
8	H, HS		7.2	84	126	252	4530	30000	4500
9	H, HS		11.4	132	200	400	7200	47500	3750
10	H, HS	U	18.0	209	315	630	11350	100000*	3600
11	H, HS	U	28.6	331	500	1000	18000	125000*	3600
12	H, HS	U	50.0	580	875		31500	225000*	2800
13	HS		75.0	870	1312		47268	368900	2400
14	HS		115.0	1334	2013		72480	593250	2200

* Urethane values are 220000, 350000, and 600000.

TYPE SC SPACER COUPLINGS
BTS - CONVENTIONAL SPACER DESIGN

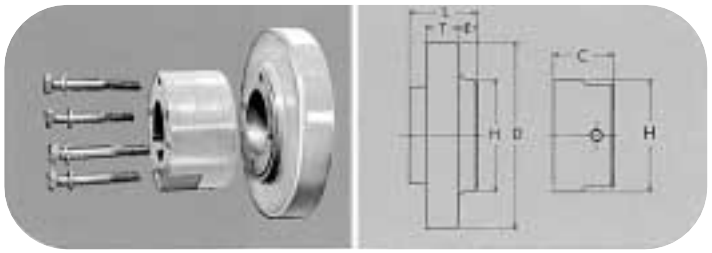
BTS - CONVENTIONAL SPACER DESIGN



The table below shows assembled dimensions of Sure-Flex Type SC Spacer Couplings. For dimensions of separate components, refer to page F1—15.

Coupling Size	Required Distance Between Shafts	Use Flange No.	Use Hub No.	Max. Bore Std. KS	Dimensions				Wt. (lbs.) ■
					D	L (2)	G	R	
4JSC	3-1/2	4JSC35	....	1-1/8 (1)	2.460	5-5/8	5/8	....	2.7
5SC	3-1/2	5SC35	5SCH	1-1/8	3.250	5-5/8	3/4	9/16	4.5
6SC	3-1/2	6SC35	6SCH-6SCHS	1-3/8	4.000	5-7/8	7/8	3/4	7.3
	4-3/8	6SC44	6SCH-6SCHS	1-3/8	4.000	6-3/4	7/8	3/4	8.1
	5	6SC50	6SCH-6SCHS	1-3/8	4.000	7-3/8	7/8	3/4	8.7
7SC	3-1/2	7SC35	7SCH-7SCHS	1-5/8	4.625	6-3/8	1	5/8	9.9
	4-3/8	7SC44	7SCH-7SCHS	1-5/8	4.625	7-1/4	1	5/8	10.8
	5	7SC50	7SCH-7SCHS	1-5/8	4.625	7-7/8	1	5/8	11.4
8SC	3-1/2	8SC35	8SCH-8SCHS	1-7/8	5.450	6-7/8	1-1/8	13/16	15.2
		8SC35-10	10SCH-10SCHS	2-3/8	5.450	8-1/8	1-1/8	13/16	23.2
	4-3/8	8SC44	8SCH-8SCHS	1-7/8	5.450	7-3/4	1-1/8	13/16	16.4
	5	8SC50	8SCH-8SCHS	1-7/8	5.450	8-3/8	1-1/8	1-3/16	17.4
		8SC50-10	10SCH-10SCHS	2-3/8	5.450	9-5/8	1-1/8	1-3/16	27.2
9SC	3-1/2	9SC35	9SCH-9SCHS	2-1/8	6.350	7-1/2	1-7/16	1-1/16	18.6
	4-3/8	9SC44	9SCH-9SCHS	2-1/8	6.350	8-1/4	1-7/16	1-1/16	22.2
	5	9SC50	9SCH-9SCHS	2-1/8	6.350	8-7/8	1-7/16	1-1/16	23.2
		9SC50-11	11SCH-11SCHS	2-7/8	6.350	10-3/8	1-7/16	1-3/16	40.4
	7	9SC70-11	11SCH-11SCHS	2-7/8	6.350	12-3/8	1-7/16	1-3/16	48.2
	7-3/4	9SC78-11	11SCH-11SCHS	2-7/8	6.350	13-1/8	1-7/16	1-3/16	51.0
10SC	4-3/4	10SC48	10SCH-10SCHS	2-3/8	7.500	9-3/8	1-5/8	1-3/16	37.6
	5	10SC50	10SCH-10SCHS	2-3/8	7.500	9-5/8	1-5/8	1-3/16	38.4
	7	10SC70-13	13SCH-13SCHS	3-3/8	7.500	13-5/8	1-5/8	1-7/8	72.0
	7-3/4	10SC78-13	13SCH-13SCHS	3-3/8	7.500	14-3/8	1-5/8	1-7/8	76.0
	10	10SC100-13	13SCH-13SCHS	3-3/8	7.500	16-5/8	1-5/8	1-7/8	88.0
11SC	4-3/4	11SC48	11SCH-11SCHS	2-7/8	8.625	10-5/16	1-7/8	1-3/16	54.5
	5	11SC50	11SCH-11SCHS	2-7/8	8.625	10-3/8	1-7/8	1-3/16	54.7
	7	11SC70-14	14SCH	3-7/8	8.625	14-5/8	1-7/8	2	86.1
	7-3/4	11SC78-14	14SCH	3-7/8	8.625	15-3/8	1-7/8	2	90.3
	10	11SC100-14	14SCH	3-7/8	8.625	17-5/8	1-7/8	2	102.7
12SC	7	12SC70	12SCH-12SCHS	2-7/8	10.000	12-7/8	2-5/16	1-1/2	88.1
		12SC70-14	14SCH	3-7/8	10.000	14-5/8	2-5/16	2	99.1
	7-3/4	12SC78	12SCH-12SCHS	2-7/8	10.000	13-5/8	2-5/16	1-1/2	91.9
		12SC78-14	14SCH	3-7/8	10.000	15-3/8	2-5/16	2	103.3
	10	12SC100-14	14SCH	3-7/8	10.000	17-5/8	2-5/16	2	115.7
13SC	7-3/4	13SC78	13SCH-13SCHS	3-3/8	11.750	14-3/8	2-11/16	1-7/8	129.6
14SC	7-3/4	14SC78	14SCH	3-7/8	13.875	15-3/8	3-1/4	2	179.9

■ Approximate weight for completely assembled spacer coupling.
(1) 4JSC35 x 1-1/8 has shallow keyseat. (2) "L" dimension and weight will change if one or two short (HS) hubs used.
Note: Refer to page F1—15 to order — specify components separately.



TYPE SC FLANGES AND HUBS

Tables on page F1—15 provide dimensional information for flanges and hubs used for Spacer Couplings. For assembled dimensions, see table above. Any of the sleeves shown on page F1—5 may be used.

TYPE SC FLANGES AND HUBS
BTS - CONVENTIONAL SPACER DESIGN

TB Wood's

(ILLUSTRATION AND DIMENSIONAL DRAWINGS SHOWN AT BOTTOM OF PAGE F1—14.)

Coupling Size	Flange No.	For Distance Between Shafts*	For Hub	Dimensions					Wt. (lbs.) ■
				D	E	H	L	T	
4JSC	4JSC35	3-1/8	...	2.460	2-1/16	2	2-1/2	7/16	1.3
5SC	5SC35	3-1/2	5SCH	3.250	51/64	2	1-11/16	19/32	1.3
6SC	6SC35	3-1/2	6SCH-6SCHS	4.000	19/32	2-1/2	1-5/8	23/32	2.0
	6SC44	4-3/8	6SCH-6SCHS	4.000	1-1/32	2-1/2	2-1/16	23/32	2.4
	6SC50	5	6SCH-6SCHS	4.000	1-11/32	2-1/2	2-3/8	23/32	2.7
7SC	7SC35	3-1/2	7SCH-7SCHS	4.625	15/32	2-13/16	1-5/8	25/32	2.5
	7SC44	4-3/8	7SCH-7SCHS	4.625	29/32	2-13/16	2-1/16	25/32	3.0
	7SC50	5	7SCH-7SCHS	4.625	1-7/32	2-13/16	2-3/8	25/32	3.3
8SC	8SC35	3-1/2	8SCH-8SCHS	5.450	9/32	3-1/4	1-5/8	29/32	3.7
	8SC35-10	3-1/2	10SCH-10SCHS	5.450	9/32	4-3/8	1-5/8	29/32	3.5
	8SC44	4-3/8	8SCH-8SCHS	5.450	23/32	3-1/4	2-1/16	29/32	4.3
	8SC50	5	8SCH-8SCHS	5.450	1-1/32	3-1/4	2-3/8	29/32	4.8
	8SC50-10	5	10SCH-10SCHS	5.450	1-1/32	4-3/8	2-3/8	29/32	5.5
9SC	9SC35	3-1/2	9SCH-9SCHS	6.350	1/16	3-5/8	1-11/16	1-1/32	4.1
	9SC44	4-3/8	9SCH-9SCHS	6.350	7/16	3-5/8	2-1/16	1-1/32	5.9
	9SC50	5	9SCH-9SCHS	6.350	3/4	3-5/8	2-3/8	1-1/32	6.4
	9SC50-11	5	11SCH-11SCHS	6.350	3/4	5-1/4	2-3/8	1-1/32	7.0
	9SC70-11	7	11SCH-11SCHS	6.350	1-3/4	5-1/4	3-3/8	1-1/32	10.9
	9SC78-11	7-3/4	11SCH-11SCHS	6.350	2-1/8	5-1/4	3-3/4	1-1/32	12.3
10SC	10SC48	4-3/4	10SCH-10SCHS	7.500	11/32	4-3/8	2-1/4	1-7/32	9.8
	10SC50	5	10SCH-10SCHS	7.500	15/32	4-3/8	2-3/8	1-7/32	10.2
	10SC70-13	7	13SCH-13SCHS	7.500	1-15/32	6-1/8	3-3/8	1-7/32	14.5
	10SC78-13	7-3/4	13SCH-13SCHS	7.500	1-27/32	6-1/8	3-3/4	1-7/32	16.5
	10SC100-13	10	13SCH-13SCHS	7.500	2-31/32	6-1/8	4-7/8	1-7/32	22.5
11SC	11SC48	4-3/4	11SCH-11SCHS	8.625	1/32	5-1/4	1-1/2	1-1/2	12.5
	11SC50	5	11SCH-11SCHS	8.625	1/16	5-1/4	1-9/16	1-1/2	12.6
	11SC70-14	7	14SCH	8.625	1-1/16	6-1/2	2-9/16	1-1/2	16.3
	11SC78-14	7-3/4	14SCH	8.625	1-7/16	6-1/2	2-15/16	1-1/2	18.4
	11SC100-14	10	14SCH	8.625	2-9/16	6-1/2	4-1/16	1-1/2	24.6
12SC	12SC70	7	12SCH-12SCHS	10.000	21/32	5-3/4	2-15/32	1-11/16	23.4
	12SC70-14	7	14SCH	10.000	21/32	6-1/2	2-15/32	1-11/16	21.3
	12SC78	7-3/4	12SCH-12SCHS	10.000	1-1/32	5-3/4	2-27/32	1-11/16	25.3
	12SC78-14	7-3/4	14SCH	10.000	1-1/32	6-1/2	2-27/32	1-11/16	23.4
	12SC100-14	10	14SCH	10.000	2-5/32	6-1/2	3-31/32	1-11/16	29.6
13SC	13SC78	7-3/4	13SCH-13SCHS	11.750	9/16	6-1/8	3-1/4	1-31/32	38.4
14SC	14SC78	7-3/4	14SCH	13.875	1/32	6-1/2	2-23/32	2-1/4	55.2

* Flanges can be mixed to form different Between-Shaft Dimensions. See chart page F1—16. ■ Approximate weight for each flange.
▲ If using 10HS hub, 7/16-14NC x 2-1/4 long capscrew needed (not furnished).

Coupling Size	Hub No.	Max. Bore	STOCK BORES *		Dimensions			Wt. (lbs.) ■
			Plain Bore	Bore with Standard Keyway & Set Screw	C	H	Cap Screws Furnished	
4JSC	†	1-1/8	...	5/8 – 7/8 – 1 – 1-1/8*	1-1/16	2	...	...
5SC	5SCH	1-1/8	1/2	5/8 – 3/4 – 7/8 – 1 – 1-1/8	1-3/32	2	4—10 x 1-1/2	.8
6SC	6SCH	1-3/8	5/8	3/4 – 7/8 – 1 – 1-1/8 –1-1/4–1-3/8	1-7/32	2-1/2	4—1/4 x 1-3/4	1.4
	6SCHS	7/8	. . .	7/8	31/32	2-1/2	4—1/4 x 1-1/2	1.1
7SC	7SCH	1-5/8	5/8	7/8 – 1 – 1-1/8 – 1-3/8 – 1-1/2 – 1-5/8	1-15/32	2-13/16	4—1/4 x 1-7/8	2.0
	7SCHS	7/8	. . .	7/8	1-3/32	2-13/16	4—1/4 x 1-1/2	1.5
8SC	8SCH	1-7/8	3/4	7/8 – 1 – 1-1/8 – 1-3/8 – 1-1/2 – 1-5/8 – 1-3/4 – 1-7/8	1-23/32	3-1/4	4—5/16 x 2-1/4	3.2
	8SCHS	7/8	. . .	7/8	1-7/32	3-1/4	4—5/16 x 1-3/4	2.0
9SC	9SCH	2-1/8	7/8	1 – 1-1/8 – 1-3/8 – 1-1/2 – 1-5/8 – 1-3/4 – 1-7/8 – 2-1/8	1-31/32	3-5/8	4—3/8 x 2-3/4	4.2
	9SCHS	1-1/2	...	1-1/8	1-17/32	3-5/8	4—3/8 x 2-1/4	3.7
10SC	10SCH	2-3/8	1-1/8	1-5/8 – 1-7/8 – 2-1/8 – 2-3/8	2-11/32	4-3/8	4—7/16 x 3-1/4	7.4
	10SCHS	1-5/8	...	1-1/8	1-21/32	4-3/8	4—7/16 x 2-1/2	5.5
11SC	11SCH	2-7/8	1-1/8	1-7/8 – 2-1/8 – 2-3/8 – 2-7/8	2-23/32	5-1/4	4—1/2 x 3-1/2	12.2
	11SCHS	1-7/8	...	1-1/8 – 1-5/8	1-29/32	5-1/4	4—1/2 x 2-3/4	9.3
12SC	12SCH	2-7/8	1-3/8	2-1/8 – 2-3/8 – 2-7/8	2-31/32	5-3/4	4—5/8 x 4	16.6
	12SCHS	2-1/2	...	2-3/8	2-17/32	5-3/4	4—5/8 x 3-1/2	14.1
13SC	13SCH	3-3/8	1-3/8	2-3/8 – 2-7/8 – 3-3/8	3-11/32	6-1/8	4—5/8 x 4-1/2	19.9
	13SCHS	2-1/2	...	2-1/8 – 2-3/8	2-15/32	6-1/8	4—5/8 x 3-1/2	16.0
14SC	14SCH	3-7/8	1-5/8	2-3/8 – 2-7/8 – 3-3/8 – 3-7/8	3-27/32	6-1/2	4—5/8 x 5	24.2

† FOR 4JSC the hub is an integral part of the flange. 4JSC x 1-1/8 has 1/4 x 1/16 shallow keyseat. ■ Approximate weight for each hub.
* See page F1—10 for bore tolerances F1—13 for std. keyseat dimensions.

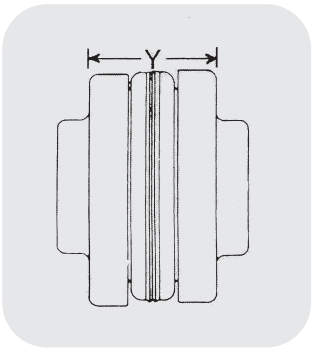
Installation Instructions

Sure-Flex flanges (outer metallic parts) and sleeves (inner elastomeric members) come in many sizes and types. First, determine the size and type of components being used. Remove all components from their boxes, and loosely assemble the coupling on any convenient surface. (Do not attempt to install the wire ring on the two-piece E or N sleeve at this time.) Also check maximum RPM values in the table against operating speed. All rubber sleeves (EPDM and Neoprene) have the same ratings for a given size and may be used interchangeably. However, because rubber and Hytrel sleeves have completely different ratings, they never should be used interchangeably.

1 Inspect all coupling components and remove any protective coatings or lubricants from bores, mating surfaces and fasteners. Remove any existing burrs, etc. from the shafts.

2 Slide one coupling flange onto each shaft, using snug-fitting keys where required. When using Type B flanges, follow the instructions furnished with the Sure-Grip bushing.

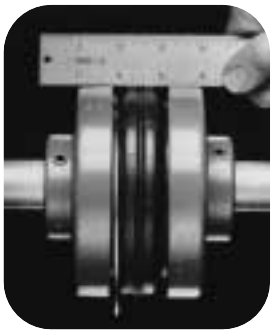
3 Position the flanges on the shafts to approximately achieve the Y dimension shown in the table. It is usually best to have an equal length of shaft extending into each flange. Move one flange to its final position. Torque fasteners to proper values. Slide the other flange far enough away to install the sleeve. With a two-piece sleeve, do not move the wire ring to its final position; allow it to hang loosely in the groove adjacent to the teeth.



4 Slide the loose flange on the shaft until the sleeve is completely seated in the teeth of each flange. (The "Y" dimension is for reference and not critical.) Secure the flange to the shaft. Different coupling sleeves require different degrees of alignment precision. Locate the alignment values for your sleeve size and type in the table.

5 Check parallel alignment by placing a straight-edge across the two coupling flanges and measuring the maximum offset at various points around the periphery of the coupling without rotating the coupling. If the maximum offset exceeds the figure shown under "Parallel" in the table, realign the shafts.

6 Check angular alignment with a micrometer or caliper. Measure from the outside of one flange to the outside of the other at intervals around the periphery of the coupling. Determine the maximum and minimum dimensions without rotating the coupling. The difference between the maximum and minimum must not exceed the figure given under "Angular" in the table. If a correction is necessary, be sure to recheck the parallel alignment.



Parallel

Angular

MAXIMUM RPM AND ALLOWABLE MISALIGNMENT

(Dimensions in inches)

Sleeve Size	Maximum RPM	Types JE, JN, JES, JNS, E & N			*Type H & HS		
		Parallel	Angular	Y	Parallel	Angular	Y
3	9200	.010	.035	1.188	...	...	...
4	7600	.010	.043	1.500	...	...	...
5	7600	.015	.056	1.938	...	...	...
6	6000	.015	.070	2.375	.010	.016	2.375
7	5250	.020	.081	2.563	.012	.020	2.563
8	4500	.020	.094	2.938	.015	.025	2.938
9	3750	.025	.109	3.500	.017	.028	3.500
10	3600	.025	.128	4.063	.020	.032	4.063
11	3600	.032	.151	4.875	.022	.037	4.875
12	2800	.032	.175	4.688	.025	.042	5.688
13	2400	.040	.195	6.688	.030	.050	6.625
14	2200	.045	.242	7.750	.035	.060	7.750
16	1500	.062	.330	10.250	...	...	...

Note: Values shown above apply if the actual torque transmitted is more than 1/4 the coupling rating. For lesser torque, reduce the above values by 1/2.

*Type H and HS sleeves **should not** be used as direct replacements for EPDM or Neoprene sleeves.

7 If the coupling employs the two-piece sleeve with the wire ring, force the ring into its groove in the center of the sleeve. It may be necessary to pry the ring into position with a blunt screwdriver.

8 Install coupling guards per OSHA requirements.

CAUTION: Coupling sleeves may be thrown from the coupling assembly with substantial force when the coupling is subjected to a severe shock load or abuse.

I Section 11342: Carbon Recirculation Pumps
E. Spare Parts Furnished

Spare Parts Furnished:

One (1) Mechanical Seal
One (1) Idler Pin, Bushing, etc.

I Section 11342: Carbon Recirculation Pumps
F. Push Button Station

Product Description

The 30.5 mm pushbutton line features a zinc die cast construction with chrome-plated housing and mounting nut. The same durable construction is also available with the corrosive resistant E34 line of pushbuttons. See E34 section on **Pages 47-166** – **47-189**.

Reliability Nibs

Eaton's Cutler-Hammer® contact blocks feature enclosed silver contacts with pointed "reliability nibs" for reliable performance from logic level up to 600V. To ensure reliable switching, nibs bite through oxide which can form on silver contacts, eliminating the need for expensive logic level blocks for most applications.

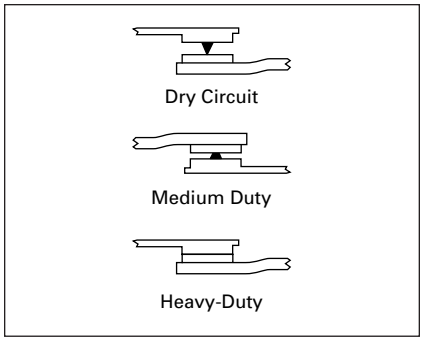


Figure 47-90. Reliability Nibs

Reliability nibs improve performance in dry circuit, corrosive, fine dust and other contaminated atmospheres. Under normal environmental conditions, the minimum operational voltage is 5V and the minimum operational current is 1 mA, AC/DC. For operation under a wider range of environmental conditions, logic level contact blocks with inert palladium tipped contacts are recommended.

Grounding Nibs

10250T line operators have "grounding nibs" — four metal points on the operator casting designed to bite through most paints and other coatings on metal panels to enhance the ground connection when the operator is securely tightened.

Grounding Nibs

Diaphragm Seal with Drainage Holes

Liquid Drainage

Eaton's Cutler-Hammer pushbutton operators offer front of panel drainage via holes in the operator bushing. Hidden from view by the mounting nut, these holes prevent buildup of liquid inside the operator, which can prevent operation in freezing environments. The holes also provide a route for escaping liquid in high pressure washdowns, effectively relieving pressure from the internal diaphragm seal, ensuring reliable sealing in applications even beyond NEMA 4.

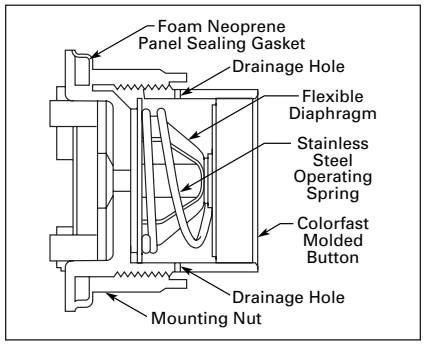
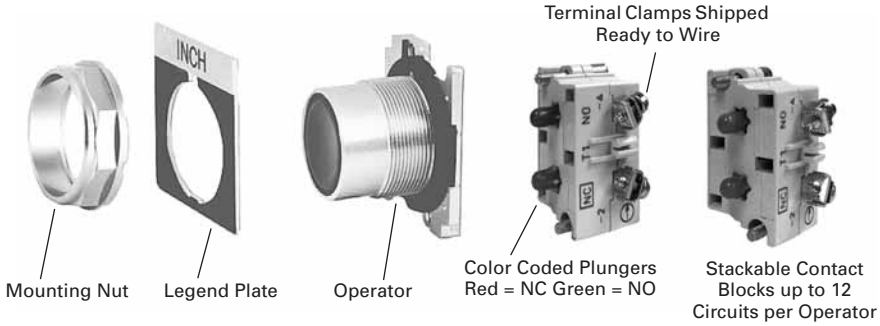


Figure 47-91. Diaphragm Seal



10250T Series

Features

- Heavy-duty zinc die cast construction
- Enclosed silver contacts with reliability nibs
- Diaphragm seals with drainage holes
- Grounding nibs on the operator casing

Benefits

- Reliability nibs improve contact reliability even under dry circuit and fine dust conditions
- Drainage holes prevent buildup of liquid inside the operator which can prevent operation in freezing environments
- Grounding nibs bit through paint and other coatings to provide secure ground

Contact Operation

Slow make and break. All normally closed contacts have positive opening operation, i.e., normally closed contacts are forced open in the event of contact weld or spring breakage.

Standards and Certifications

- CE EN60947-5-1
- UL 508 — File No. 131568
- CSA C22.2 No. 14 — File No. LR68551

Ingress Protection

When mounted in similarly rated enclosure —

- Standard Indicating Lights
  - UL (NEMA) Type 1, 2, 3, 3R, 3S, 4, 4X, 12, 13
  - IEC IP65
- All Other Operators
  - UL (NEMA) Type 1, 2, 3, 3R, 4, 4X, 12, 13
  - IEC IP65

Technical Data and Specifications

Mechanical Ratings

- Frequency of operation
  - All pushbuttons: 6000 operations/hr.
  - Key and lever selector switches: 3000 operations/hr.
  - Auto-latch devices: 1200 operations/hr.
- Life
  - Pushbuttons: 10 x 10^6 operations
  - Contact blocks: 10 x 10^6 operations
  - PresTest units: 10 x 10^6 operations
  - Lever and key selector switches: 0.25 x 10^6 operations
  - Twist to release pushbuttons: 0.3 x 10^6 operations
- Shock resistance
  - Duration: 20 mS ≥ 5g

Climate Conditions

- Operating Temperature: 1° to 150°F (-17° to 66°C)
- Storage Temperature: -40° to 176°F (-40° to 80°C)
- Altitude: 6,562 ft. (2,000m)
- Humidity: Max. 95% RH @ 60°C

Terminals

- Marking
  - NC-NO on the contact block to meet the NEMA requirements. Dual marking system 1 – 2 for normally closed, 3 – 4 for normally open to meet BS5472 (Cenelec EN50 005)
- Clamps
  - Terminals are saddle clamp type for 1 x 22 AWG (0.34 mm^2) to 2 x 14 AWG (2.5 mm^2) conductors
- Torque = 7 lb-in (0.8 Nm)
- Degree of protection against direct electrical contact: IP2X with fingerproof shroud

Light Units

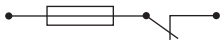
- Transformers: will withstand short circuit for 1 hour per IEC 60997-5-1
- Bulbs — average life
  - Transformer type: 20,000 hrs.
  - Resistor/direct voltage type: 2500 hrs. minimum @ rated V
  - LED: 60,000 to 100,000 hrs.

Electrical Ratings

- Insulation: Ui = 660V AC or DC
- Thermal: Ith = 10A

Short Circuit Coordination to IEC/EN 60947-5-1

- Rated conditional short circuit current: 1 kA
- Fuse type: GE Power Controls TIA 10, Red Spot Type gG, 10A, 660V AC, 460V DC, BS88-2, IEC 60269-2-1



Fuse

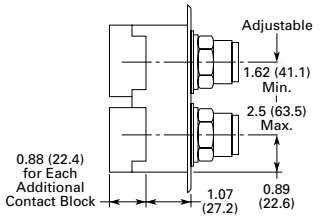
- UL rating: A600, P600
  - AC load life duty cycle 1200 operations/hour
    - 10A: 110V pf 0.4 – 1 x 10^6 operations
    - 5A: 250V pf 0.4 – 1 x 10^6 operations
    - 2A: 660V pf 0.4 – 1 x 10^6 operations
- Switching capacity
  - AC15 rated make/break (11 x Ie at 1.1 x Ue)
    - 6A: 120V pf 0.3
    - 4A: 240V pf 0.3
    - 2A: 660V pf 0.3
  - DC13 rated make/break (1.1 x Ie at 1.1 x Ue)
    - 1.0A: 125V L/R ≥ 0.95 at 300 mS
    - .55A: 250V L/R ≥ 0.95 at 300 mS
    - .1A: 660V L/R ≥ 0.95 at 300 mS
    - 10A: 110V pure resistive
- Maximum ratings for logic level and hostile atmosphere application
  - Maximum amperes: 0.5A
  - Maximum volts: 120V AC/DC

Table 47-171. Contact Block

Meet or Exceed NEMA Rating Designations A600, A300 and B300 for AC and P600 for DC							
Description	**Volts AC 50 or 60 Hz**				**Volts DC**		
	120	**240**	**480**	**600**	**24/28**	**125**	**250**
Make and Emerg. Interrupting Capacity (Amp)	60	30	15	12	5.7	1.1	0.55
Normal Load Break (Amp)	6	3	1.5	1.2	5.7	1.1	0.55
Thermal Current (Amp)	10	10	10	10	5.0	5.0	5.0
Voltamperes:							
Make and Emerg. Interrupting Capacity	7200	7200	7200	7200	138	138	138
Normal Load Break	720	720	720	720	138	138	138

Pushbuttons (Continued)

Table 47-175. Mechanically Interlocked Pushbutton Operators — UL (NEMA) Type 3, 3R, 4, 4X, 12, 13

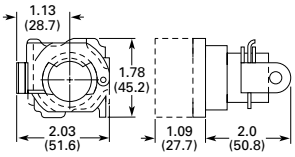
	Description	Catalog Number	Price U.S. $	Overall Dimensions in Inches (mm)
	Minimum hole centers 1.62", maximum 250". Mounts in extra deep enclosures only.			
	Black flush and green flush	**10250TA66**		
	Black flush and long red	**10250TA67**		
	Black flush and red mushroom head	**10250TA68**		
	Black flush and lock-down red mushroom head	**10250TA69** ①		
	Black flush and red jumbo mushroom head	**10250TA76**		
	Green flush and long red	**10250TA72**		
	Black long and long red	**10250TA73**		
	Green flush and red mushroom head	**10250TA77**		
	Green flush and black flush	**10250TA75**		

① NC contacts must be mounted behind lock-down mushroom head operator to ensure lockout.

Lockout Pushbutton Operators with Padlock Attachments

The following pushbutton and mushroom operators include an integral padlock attachment for applications requiring lockout/tagout of specific machine functions. They are available in styles which allow locking of a button in the down position (stopped position) or locking a button in the up position (to prevent starting). Select the **"Hand"** latch type which functions as a momentary pushbutton until the operator presses the button and moves the padlock attachment into position for locking, or choose the **"Spring Loaded"** latch type where the padlock attachment springs into place when the button is pressed. Units accept a customer supplied 1/4" padlock.

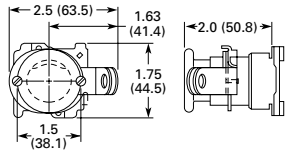
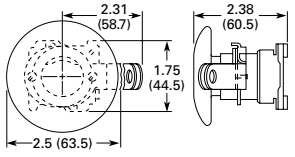
Table 47-176. Padlockable in the Down Position ② — UL (NEMA) Type 3, 3R, 4, 4X, 12, 13

	Operator Type	Color	Latch Type	Catalog Number	Price U.S. $	Overall Dimensions in Inches (mm)
	Flush Head	Red	Hand	**10250TA16**		
	Mushroom Head	Red	Hand	**10250TA42**		
		Red	Spring Loaded	**10250TA45**		
	Jumbo Head ③	Red	Hand	**10250TA52**		
		Red	Spring Loaded	**10250TA55**		
		Red (EMERG. STOP)	Spring Loaded	**10250ED952**		

② Operators can be latched down without a padlock. Padlock not included.

③ Jumbo mushroom heads are not recommended for use in applications where exposure to ultraviolet light exists.

Table 47-177. Padlockable in the Up Position ④ — UL (NEMA) Type 3, 3R, 4, 4X, 12, 13

	Operator Type	Color	Latch Type	Catalog Number	Price U.S. $	Overall Dimensions in Inches (mm)
	Mushroom Head	Black	Hand	**10250TA41**		
		Green	Hand	**10250TA43**		
	Jumbo Mushroom Head ⑤	Black	Hand	**10250TA51**		
		Green	Hand	**10250TA53**		
		Yellow	Hand	**10250TA54**		

④ Operators can be latched down without a padlock. Padlock not included.

⑤ Jumbo mushroom heads are not recommended for use in applications where exposure to ultraviolet light exists.

Note: Hand Attachment must be manually moved into place for locking. Spring Loaded: when operator is pressed — attachment springs into place. Must be moved manually to release button.

Contact Blocks . . . . . **Page 47-148**
Enclosures . . . . . **Pages 47-153 – 47-154**
Discount Symbol **1CD1C**

Pushbutton Enclosures

30.5-mm and 22.5-mm Pushbutton Enclosures, Type 4X

Industry Standards

UL 508A Listed; Type 4, 4X, 12; File Number E61997
cUL Listed per CSA C22.2 No 94; Type 4, 4X, 12; File Number E61997

NEMA/EEMAC Type 4X, 12, 13
CSA File Number 42186: Type 4, 4X, 12
IEC 60529, IP66

Application

Punched specifically to house either 30.5-mm or 22.5-mm oil-tight pushbuttons, switches and pilot lights. Enclosures provide protection against dirt, dust, oil and water.
See Mild Steel chapter for related mild steel enclosures.

Specifications

- 14 gauge bodies, 16 gauge covers; Type 304 or Type 316 stainless steel
- Seams continuously welded and ground smooth
- Captivated cover screws thread into sealed wells
- Bonding provision on door; grounding nut on body
- 4-way pushbutton holes accept all brands of oil-tight pushbuttons, switches and pilot lights
- Enclosures with more than one column of pushbutton holes have internal detachable hinge to hold cover open during wiring, yet permit immediate removal
- Oil-resistant gasket

Finish

Cover and sides of body have smooth #4 brushed finish.

Accessories

See also Accessories.
Industrial Corrosion Inhibitors, page 1248
HOL-SEALERS™ Hole Seals
Tamper-Resistant Screws
Bulletin: PB1S

Standard Product

Catalog Number	AxBxC in./mm	Hole Size	Stainless Steel Type	Gauge	Number of Holes	Mounting G x H in./mm	Overall L x W in./mm	J in./mm	T in./mm	X in./mm	Y in./mm
E1PBSS	3.50 x 3.25 x 2.75 89 x 83 x 70	30.5 mm	Type 304	16	1	4.00 x 2.38 102 x 60	4.50 x 3.47 114 x 88	2.31 59	3.00 76	1.73 47	1.86 47
E1PBSS6	3.50 x 3.25 x 2.75 89 x 83 x 70	30.5 mm	Type 316	16	1	4.00 x 2.38 102 x 60	4.50 x 3.47 114 x 88	2.31 59	3.00 76	1.73 47	1.86 47
E1PBGSS	3.50 x 3.25 x 2.75 89 x 83 x 70	22.5 mm	Type 304	16	1	4.00 x 2.38 102 x 60	4.50 x 3.47 114 x 88	2.31 59	3.00 76	1.73 47	1.86 47
E2PBSS	5.75 x 3.25 x 2.75 146 x 83 x 70	30.5 mm	Type 304	16	2	6.25 x 2.38 159 x 60	6.75 x 3.47 171 x 88	2.31 59	3.00 76	1.73 44	1.86 47
E2PBSS6	5.75 x 3.25 x 2.75 146 x 83 x 70	30.5 mm	Type 316	16	2	6.25 x 2.38 159 x 60	6.75 x 3.47 171 x 88	2.31 59	3.00 76	1.73 44	1.86 47
E2PBGSS	5.75 x 3.25 x 2.75 146 x 83 x 70	22.5 mm	Type 304	16	2	6.25 x 2.38 159 x 60	6.75 x 3.47 171 x 88	2.31 59	3.00 76	1.73 44	1.86 47
E3PBSS	8.00 x 3.25 x 2.75 203 x 83 x 70	30.5 mm	Type 304	14	3	8.50 x 2.38 216 x 60	9.00 x 3.47 229 x 88	2.31 59	3.00 76	1.73 44	1.86 47
E3PBSS6	8.00 x 3.25 x 2.75 203 x 83 x 70	30.5 mm	Type 316	14	3	8.50 x 2.38 216 x 60	9.00 x 3.47 229 x 88	2.31 59	3.00 76	1.73 44	1.86 47
E3PBGSS	8.00 x 3.25 x 2.75 203 x 83 x 70	22.5 mm	Type 304	14	3	8.50 x 2.38 216 x 60	9.00 x 3.47 229 x 88	2.31 59	3.00 76	1.73 44	1.86 47
E4PBSS	10.25 x 3.25 x 2.75 260 x 83 x 70	30.5 mm	Type 304	14	4	10.75 x 2.38 273 x 60	11.25 x 3.47 286 x 88	2.31 59	3.00 76	1.73 44	1.86 47
E4PBSS6	10.25 x 3.25 x 2.75 260 x 83 x 70	30.5 mm	Type 316	14	4	10.75 x 2.38 273 x 60	11.25 x 3.47 286 x 88	2.31 59	3.00 76	1.73 44	1.86 47
E4PBGSS	10.25 x 3.25 x 2.75 260 x 83 x 70	22.5 mm	Type 304	14	4	10.75 x 2.38 273 x 60	11.25 x 3.47 286 x 88	2.31 59	3.00 76	1.73 44	1.86 47
E6PBSS	9.50 x 6.25 x 3.00 241 x 159 x 76	30.5 mm	Type 304	14	6	10.00 x 5.38 254 x 137	10.50 x 6.47 267 x 164	2.56 65	6.00 152	2.11 54	2.61 66
E6PBSS6	9.50 x 6.25 x 3.00 241 x 159 x 76	30.5 mm	Type 316	14	6	10.00 x 5.38 254 x 137	10.50 x 6.47 267 x 164	2.56 65	6.00 152	2.11 54	2.61 66
E6PBGSS	9.50 x 6.25 x 3.00 241 x 159 x 76	22.5 mm	Type 304	14	6	10.00 x 5.38 254 x 137	10.50 x 6.47 267 x 164	2.56 65	6.00 152	2.11 54	2.61 66

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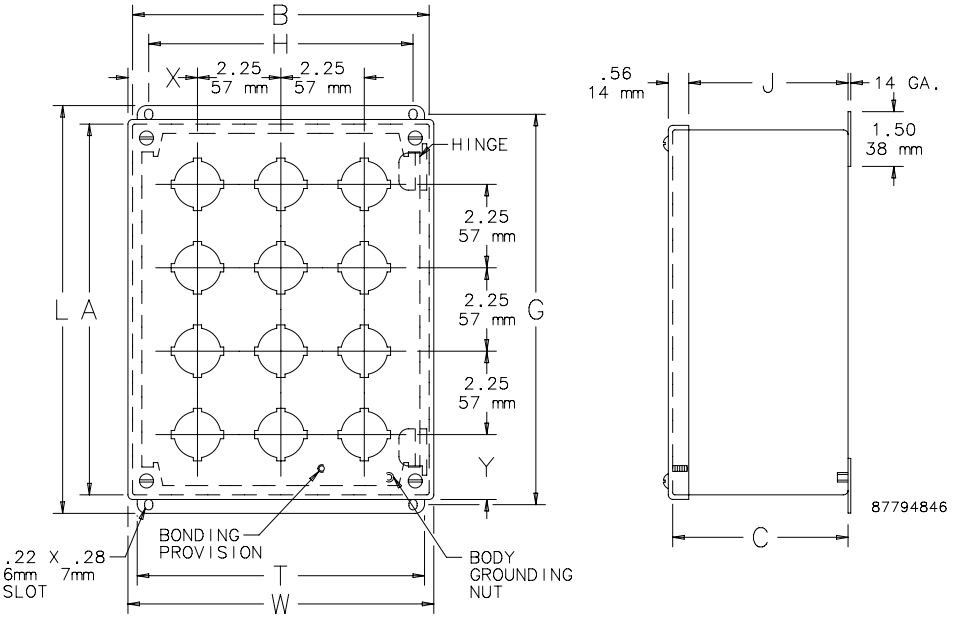
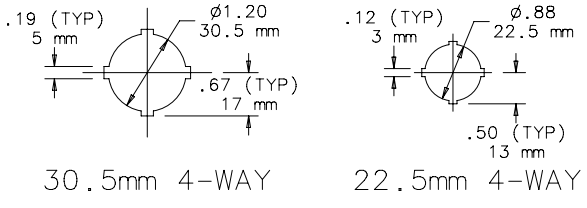
Pushbutton Enclosures

Catalog Number	AxBxC in./mm	Hole Size	Stainless Steel Type	Gauge	Number of Holes	Mounting G x H in./mm	Overall L x W in./mm	J in./mm	T in./mm	X in./mm	Y in./mm
E9PBSS	9.50 x 8.50 x 3.00 241 x 216 x 76	30.5 mm	Type 304	14	9	10.00 x 7.62 254 x 194	10.50 x 8.72 267 x 221	2.56 65	8.25 210	2.11 54	2.61 66
E9PBSS6	9.50 x 8.50 x 3.00 241 x 216 x 76	30.5 mm	Type 316	14	9	10.00 x 7.62 254 x 194	10.50 x 8.72 267 x 221	2.56 65	8.25 210	2.11 54	2.61 66
E9PBGSS	9.50 x 8.50 x 3.00 241 x 216 x 76	22.5 mm	Type 304	14	9	10.00 x 7.62 254 x 194	10.50 x 8.72 267 x 221	2.56 65	8.25 210	2.11 54	2.61 66
E12PBSS	11.75 x 8.50 x 3.00 298 x 216 x 76	30.5 mm	Type 304	14	12	12.25 x 7.62 311 x 194	12.75 x 8.72 324 x 221	2.56 65	8.25 210	2.11 54	2.61 66
E12PBSS6	11.75 x 8.50 x 3.00 298 x 216 x 76	30.5 mm	Type 316	14	12	12.25 x 7.62 311 x 194	12.75 x 8.72 324 x 221	2.56 65	8.25 210	2.11 54	2.61 66
E12PBGSS	11.75 x 8.50 x 3.00 298 x 216 x 76	22.5 mm	Type 304	14	12	12.25 x 7.62 311 x 194	12.75 x 8.72 324 x 221	2.56 65	8.25 210	2.11 54	2.61 66

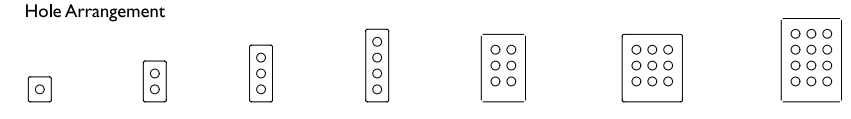
Catalog number ending in 6 is Type 316L stainless steel.





NOTE: Cover bonding provision location varies based on pushbutton pattern.

Hole Arrangement



E1PBSS E1PBSS6 E1PBGSS	E2PBSS E2PBSS6 E2PBGSS	E3PBSS E3PBSS6 E3PBGSS	E4PBSS E4PBSS6 E4PBGSS	E6PBSS E6PBSS6 E6PBGSS	E9PBSS E9PBSS6 E9PBGSS	E12PBSS E12PBSS6 E12PBGSS

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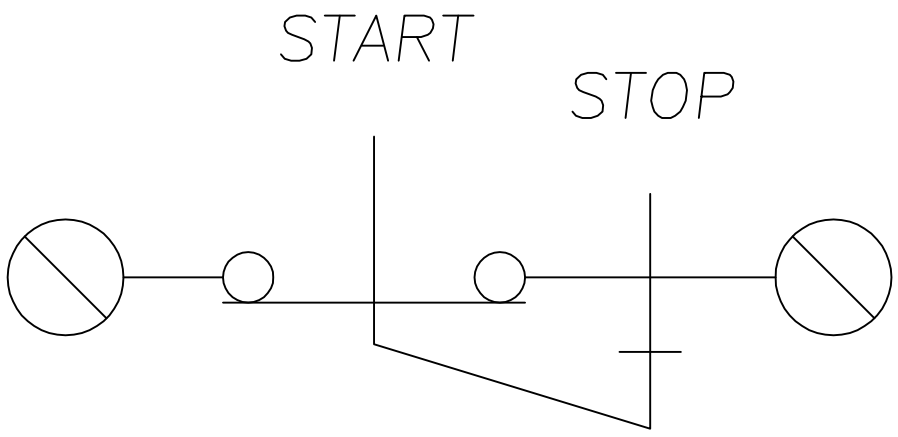

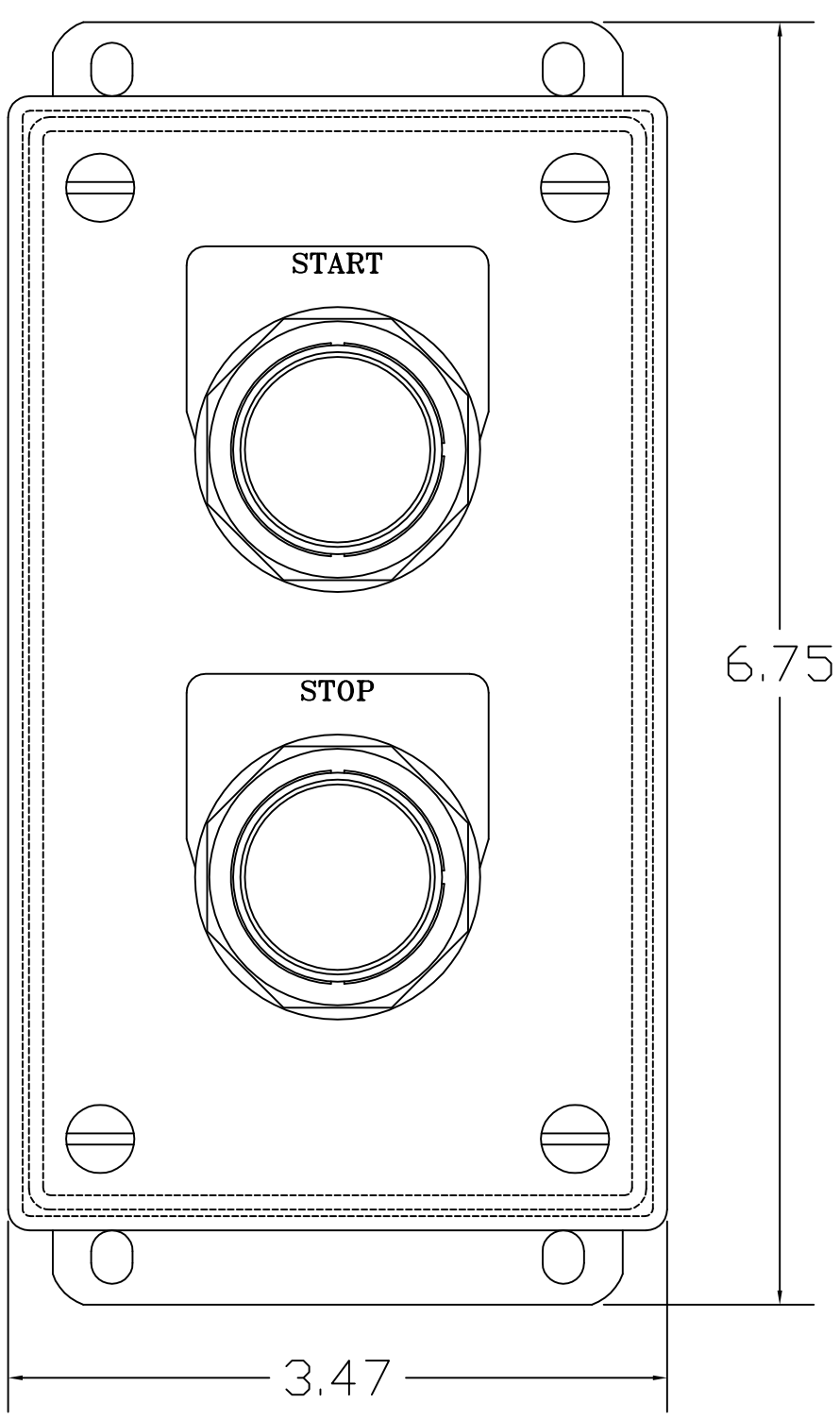

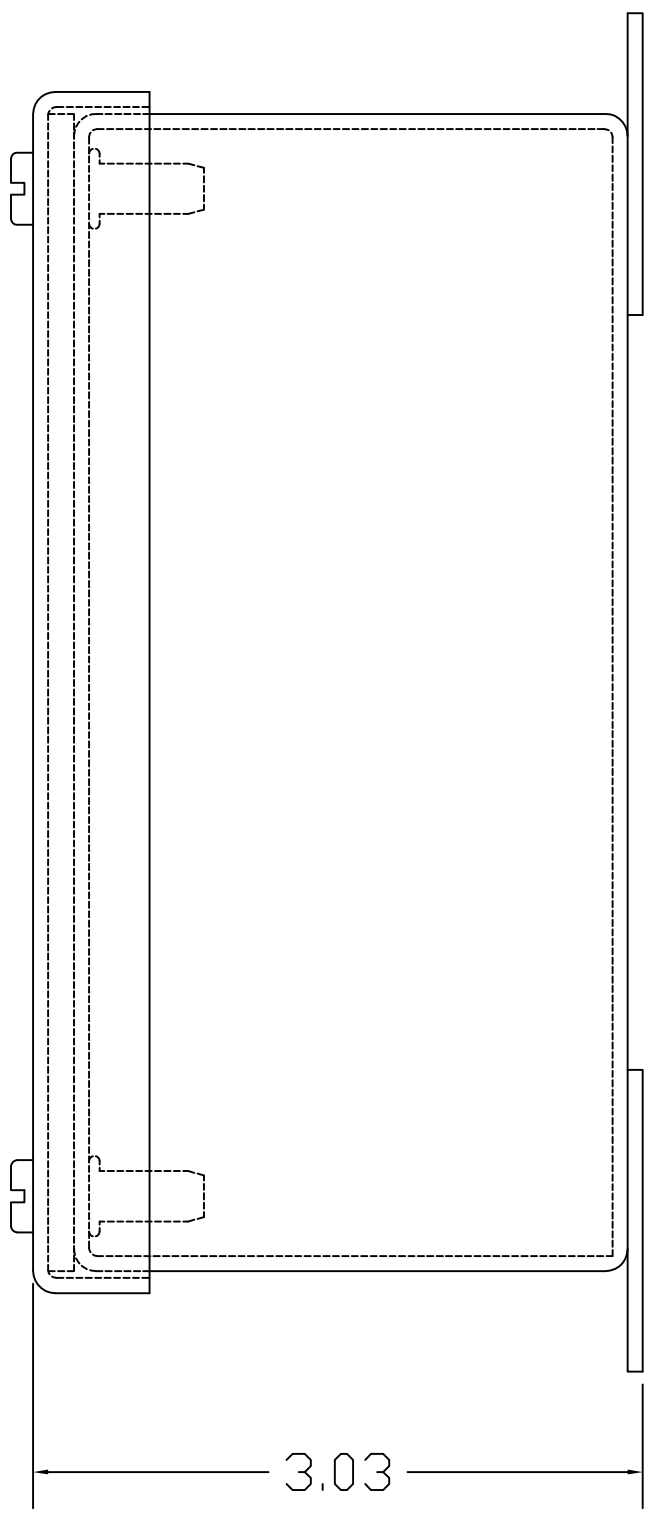

NEMA 4X 304 STAINLESS STEEL

B.W. Rogers Co.
Value Added Services Group

CUSTOMER:	GEIGER PUMP AND EQUIPMENT CO.
CSR. P.O.:	X1348B01
PROJECT:	START/STOP STATION
PROJ DESC:	2 ELEMENT PUSHBUTTON STATION W/ MECHANICALLY INTERLOCKED OPERATORS
STATUS:	RELEASED 26 APRIL 11

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LTTR	ECN #	DATE	DRAFTSMAN	DESCRIPTION
–	NONE	20 JUNE 11	JAY, JAY	INITIAL RELEASE

SCALE: NONE	ASSEMBLIES TO MAKE FROM THIS DRAWING: 2	CAD FILE NAME: 31732E11.DWG	
DRWG TITLE: ELEMENTARY DIAGRAM			SHEET: 1
DWRG NMBR: 31732E1			OF: 1

Section 11342: Viking Carbon Recirculation Pumps
Section 7: Start Up Documents

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER: Piscataway WWTP EQPT SERIAL NO.: 11025607 & 11025608
EQPT TAG NO.: CRP-1 & CRP-2 EQPT/SYSTEM: Carbon Recirc Pumps
PROJECT NO.: CD4258A05 SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

- [X] Installed under either the continuous or periodic supervision of the Manufacturer's authorized representative.
- [X] Inspected, checked, adjusted, and initially operated in the presence of the Manufacturer's representative.
- [X] Serviced with proper initial lubricants.
- [X] Electrical and mechanical connections meet quality and safety standards.
- [X] All applicable safety equipment has been properly installed.
- [X] System has been tested and meets or exceeds specified performance requirements to the Manufacturer's satisfaction. (When complete system of one manufacturer)

Comments: _____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment and (iii) authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: 5-21, 2012

Manufacturer: Viking Pump / Geiger Pump & Equipment Co.

By Manufacturer's Authorized
Representative: Steve Justice
(Authorized Signature)

GEIGER

SERVICE RECORD

☐ Smith-Koch, Inc.
A Geiger Company
830 Tryens Road
Aston, PA 19014
Ph. 610.459.1212
Fax. 610.459.3992

☒ Geiger Pump & Equipment
8924 Yellow Brick Road
Baltimore, MD 21222
Ph. 410.682.2660
Fax. 410.682.4750

SERVING THE MID-ATLANTIC SINCE 1920

www.geigerinc.com info@geigerinc.com

BILL TO:
CUSTOMER: Norair Engineering
ADDRESS: 337 Brightseat Road
CITY: Landover STATE: MD ZIP: 20875

SERVICED AT:
CUSTOMER: WSSC
ADDRESS:
CITY: Piscataway STATE: MD ZIP:

DATE: 5-21-12 & 5-22-12

SALES ORDER #:

MACHINE MANUFACTURER: Geiger Pump MODEL # & SIZE: S/N:

WORK REQUESTED:
Preliminary startup on Methanol System

WORK PERFORMED: MECHANIC: Steve Justice
* See the attached

FUTURE RECOMMENDATIONS:
* As noted on the attached

PLEASE CHECK:

WORK COMPLETED: ☐

WORK INCOMPLETE: ☒

APPROVED BY:

TIME ON JOB AT SITE *

IN____ OUT____

IN____ OUT____

IN____ OUT____

IN____ OUT____

TOTAL MILEAGE:

THIS SERVICE RECORD IS NOT AN INVOICE. YOU WILL RECEIVE AN INVOICE FOR THIS SERVICE. ONE OF THE SERVICE RECORDS SHOULD BE FORWARDED TO THE PERSON IN YOUR ORGANIZATION WHO WILL APPROVE OUR INVOICE FOR PAYMENT. SERVICES PROVIDED SUBJECT TO GEIGER STANDARD TERMS & CONDITIONS (AVAILABLE UPON REQUEST).

*TRAVEL TIME AND SHOP TIME WILL BE INVOICED IN ADDITION TO TIME INDICATED.

WHITE COPY- ORIGINAL YELLOW COPY – CUSTOMER

Piscataway Methanol Feed System
Project: CD4258A05

Carbon Metering Pumps **Pumpsafeeder E05EBEO-X Eclipse pumps**

Train 1

CFP1-1 Carbon Feed Pump No. 1-1 SN: Y886313-8
Unit has a broken gear, no testing was performed

CFP1-2 Carbon Feed Pump No. 1-2 SN: Y886313-3
Verified correct motor rotation, Set BPV to 90 PSI, set RV to 110 PSI, Flow @ 90 BP = 1.2

CFP1-3 Carbon Feed Pump No. 1-3 SN: Y886313-2
Verified correct motor rotation, Set BPV to 90 PSI, set RV to 110 PSI, Flow @ 90 BP = 1.3

CFP1-4 Carbon Feed Pump No. 1-4 SN: Y886313-1
Verified correct motor rotation, Set BPV to 90 PSI, set RV to 110 PSI, Flow @ 90 BP = 1.1

CFP1-5 Carbon Feed Pump No. 1-5 SN: Y886313-6
Verified correct motor rotation, Set BPV to 90 PSI, set RV to 110 PSI, Flow @ 90 BP = 1.3

Train 2

CFP2-1 Carbon Feed Pump No. 2-1 SN: Y886313-7
Verified correct motor rotation, Set BPV to 90 PSI, set RV to 110 PSI, Flow @ 90 BP = 1.05

CFP2-2 Carbon Feed Pump No. 2-2 SN: Y886313-5
Verified correct motor rotation, Set BPV to 90 PSI, set RV to 110 PSI, Flow @ 90 BP = 1.3

CFP2-3 Carbon Feed Pump No. 2-3 SN: Y886313-10
Verified correct motor rotation. Set BPV to 90 PSI, set RV to 110 PSI, Flow @ 90 BP = 1.05

CFP2-4 Carbon Feed Pump No. 2-4 SN: Y886313-4
Unit has a bad VFD drive, no testing was performed

CFP2-5 Carbon Feed Pump No. 2-5 SN: Y886313-9
Verified correct motor rotation, Set BPV to 90 PSI, set RV to 110 PSI, Flow @ 90 BP = 1.3

Notes: The 8 pumps are ready for service. The required parts are on order.
The broken gear is due for delivery to out facility on Friday, 6-1-12
The bad VFD drive has a 6 week delivery. We have backup plans for testing as needed.
There are calibration columns that are leaking and will be addressed on the next visit.

Carbon Recirculation Pumps **Viking Q127A pumps**

CRP-1 Carbon recirculation Pump #1 SN: 11025607
Filled gearox with Royal Purple Synfilm 220
Performed a laser coupling alignment
Verified correct motor rotation
Performed a test run

CRP-2 Carbon recirculation Pump #2 SN: 11025608
Filled gearox with Royal Purple Synfilm 220
Performed a laser coupling alignment
Verified correct motor rotation
Performed a test run

Notes: Both pumps are ready for full time service.